US009451293B2

(12) **United States Patent**
Emura

(10) **Patent No.: US 9,451,293 B2**
(45) **Date of Patent: *Sep. 20, 2016**

(54) **APPARATUS AND METHOD FOR DECODING A SEGMENT OF AN AUDIOVISUAL STREAM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 260 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/225,977**

(22) Filed: **Mar. 26, 2014**

(65) **Prior Publication Data**

US 2014/0208378 A1 Jul. 24, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/609,848, filed on Sep. 11, 2012, now Pat. No. 8,832,762, which is a continuation of application No. 13/165,111, filed on Jun. 21, 2011, now Pat. No. 8,555,328, which is a

(Continued)

(30) **Foreign Application Priority Data**

Jul. 14, 1999 (JP) H11-200095

(51) **Int. Cl.**
H04N 7/173 (2011.01)
H04N 7/12 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC ***H04N 21/23106*** (2013.01); ***H04N 21/238*** (2013.01); ***H04N 21/2353*** (2013.01);

(Continued)

(58) **Field of Classification Search**
CPC H04N 21/23106; H04N 21/238; H04N 21/2353; H04N 21/84; H04N 21/4402; H04N 21/4307; H04N 21/242; H04N 21/4586; Y10S 707/99942
USPC 725/114, 61; 348/423.1, 500; 370/476; 375/240.28
See application file for complete search history.

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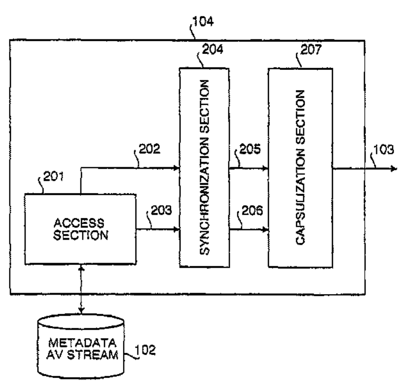
(57) **ABSTRACT**

A decoding method and apparatus are provided for decoding an audiovisual stream that is divided into a plurality of segments. The decoding method and apparatus obtain metadata that specify a segment out of the plurality of segments. The metadata is described in a structured description. The segment that is specified by the metadata is obtained, and a start time for rendering the segment from the metadata is derived. The segment is decoded based on the metadata to generate decoded segment data before the start time.

7 Claims, 19 Drawing Sheets



Related U.S. Application Data

continuation of application No. 12/899,860, filed on Oct. 7, 2010, now Pat. No. 7,992,182, which is a continuation of application No. 12/111,021, filed on Apr. 28, 2008, now Pat. No. 7,836,479, which is a continuation of application No. 10/019,319, filed as application No. PCT/JP00/04736 on Jul. 14, 2000, now Pat. No. 7,383,566.

(51) **Int. Cl.**

H04N 21/231	(2011.01)
H04N 21/242	(2011.01)
H04N 21/43	(2011.01)
H04N 21/4402	(2011.01)
H04N 21/458	(2011.01)
H04N 21/84	(2011.01)
H04N 21/235	(2011.01)
H04N 21/238	(2011.01)
H04N 5/445	(2011.01)
H04N 5/04	(2006.01)
H04J 3/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H04N21/242*** (2013.01); ***H04N 21/4307*** (2013.01); ***H04N 21/4402*** (2013.01); ***H04N 21/4586*** (2013.01); ***H04N 21/84*** (2013.01); *Y10S 707/99942* (2013.01)

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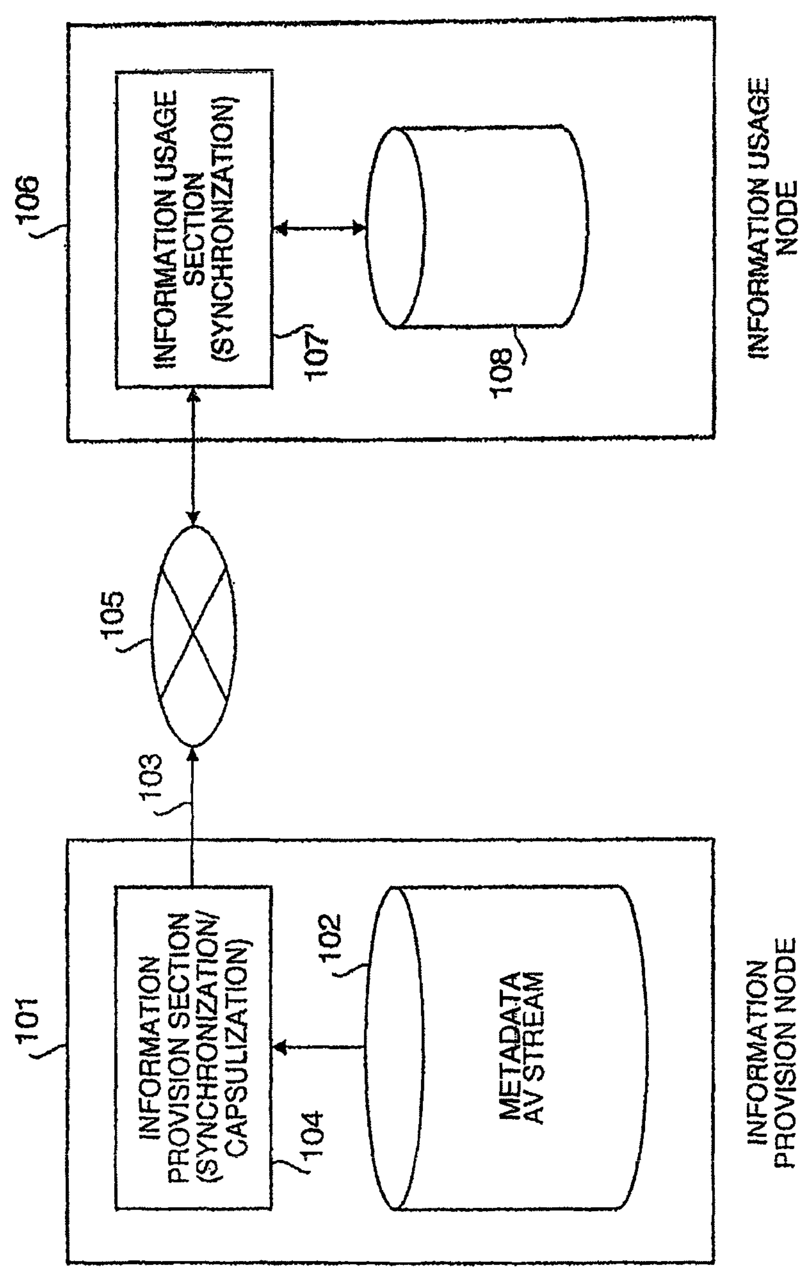

101
INFORMATION PROVISION SECTION (SYNCHRONIZATION/ CAPSULIZATION)
104
102
METADATA AV STREAM
INFORMATION PROVISION NODE
103
105
106
INFORMATION USAGE SECTION (SYNCHRONIZATION)
107
108
INFORMATION USAGE NODE

FIG. 1

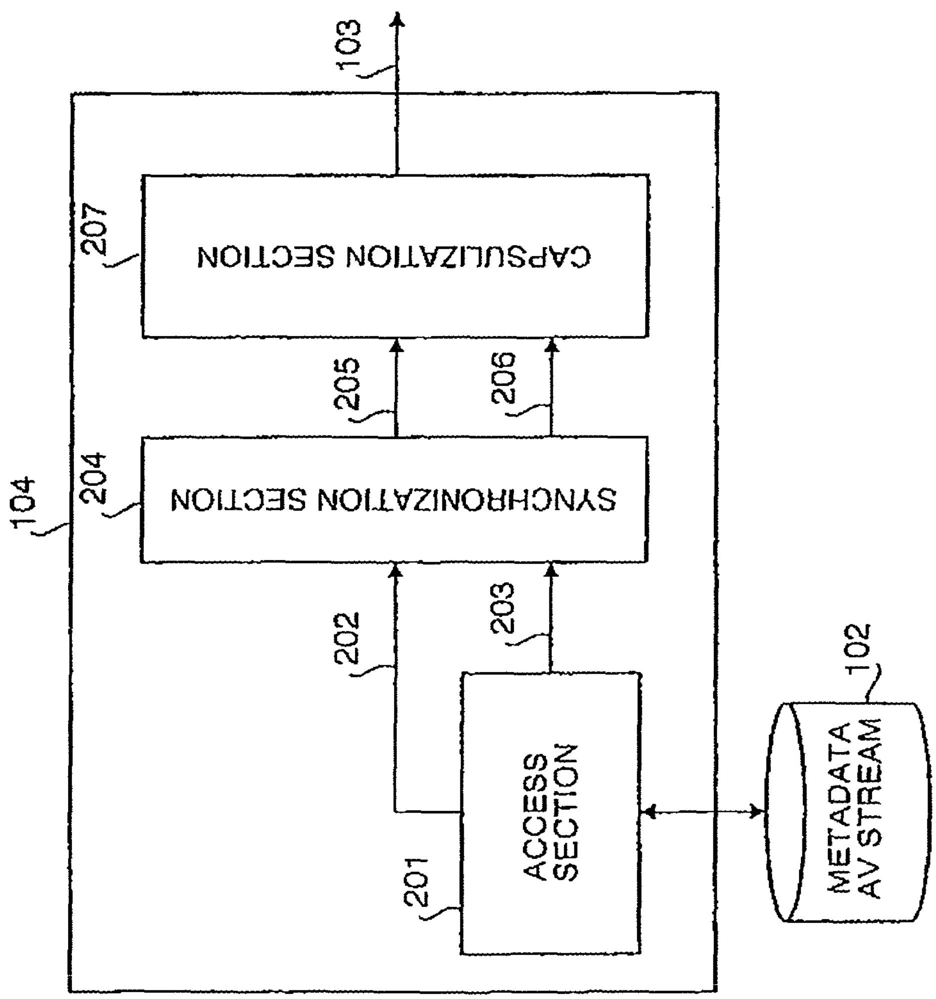

103
207
CAPSULIZATION SECTION
205
206
104
204
SYNCHRONIZATION SECTION
202
203
201
ACCESS SECTION
102
METADATA
AV STREAM

FIG. 2

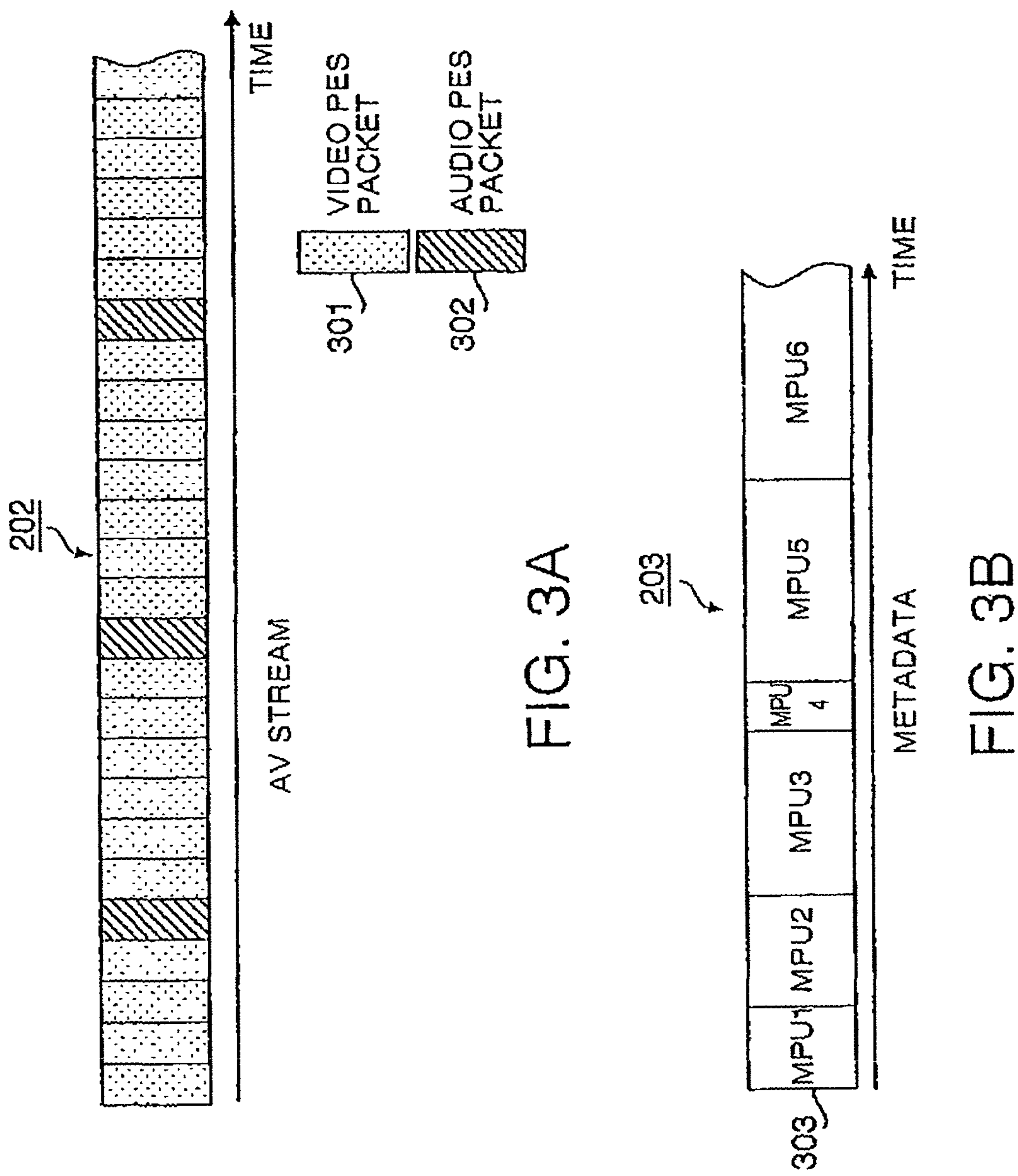

202
AV STREAM
TIME
301
VIDEO PES PACKET
302
AUDIO PES PACKET
203
MPU1
MPU2
MPU3
MPU 4
MPU5
MPU6
303
METADATA
TIME

FIG. 3A

FIG. 3B

metadata.dtd

401

```
<!ELEMENT      metadata      (mpu +)>
<!ELEMENT      mpu           SYSTEM "mpu. dtd">
 % mpu ;
```

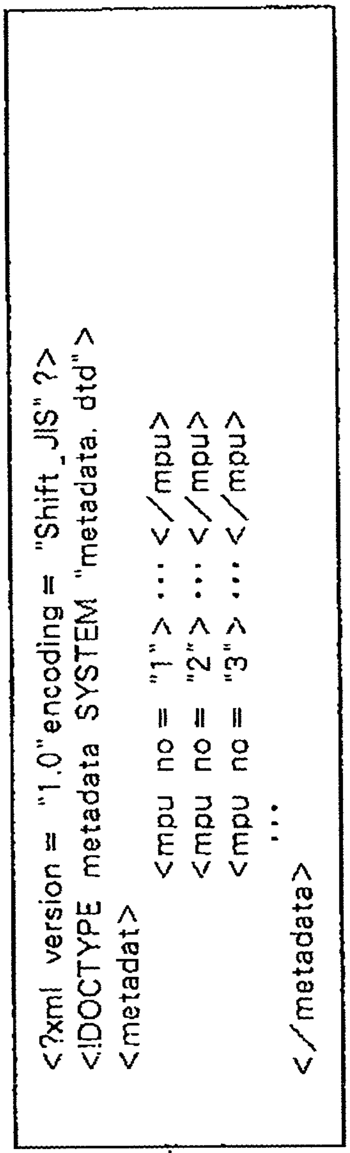
FIG. 4A

mpu.dtd

402

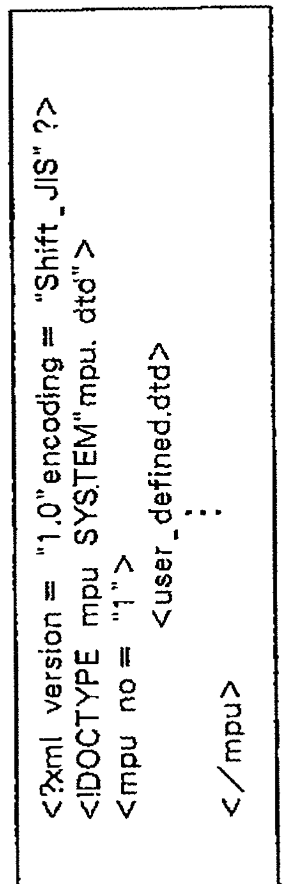
```
<!ELEMENT      mpu            (element_data +)>
<!ELEMENT      mpu            no      NMTOKEN  # REQUIRED>
<!ELEMENT      element_data   SYSTEM "user_defined. dtd">
% user_defined ;
```

FIG. 4B



501

FIG. 5A



502

FIG. 5B

SYNTAX	NUMBER OF BITS	MNEMONIC
metadata () (		
601 metadata_type	8	uimsbf
602 metadata_subtype	8	uimsbf
603 MPU_length	16	uimsbf
604 media_sync_flag	1	bslbf
if (media_sync_flag == "1") (		
605 overwrite_flag	1	bslbf
for (j = D : i < MPU_length − 2 : i += (M + 14)) (		
606 element_data_length	16	uimsbf
607 start_time ()	48	bslbf
608 duration ()	48	bslbf
element_data 609	8M	bslbf
)		
reserved	7	bslbf
)		
610 else (		
for (j = D : i < MPU_length − 1 : i += (M + 2)) (		
element_data_length	16	uimsbf
element_data	8M	bslbf
)		
)		
reserved	7	bslbf
)		

FIG. 6

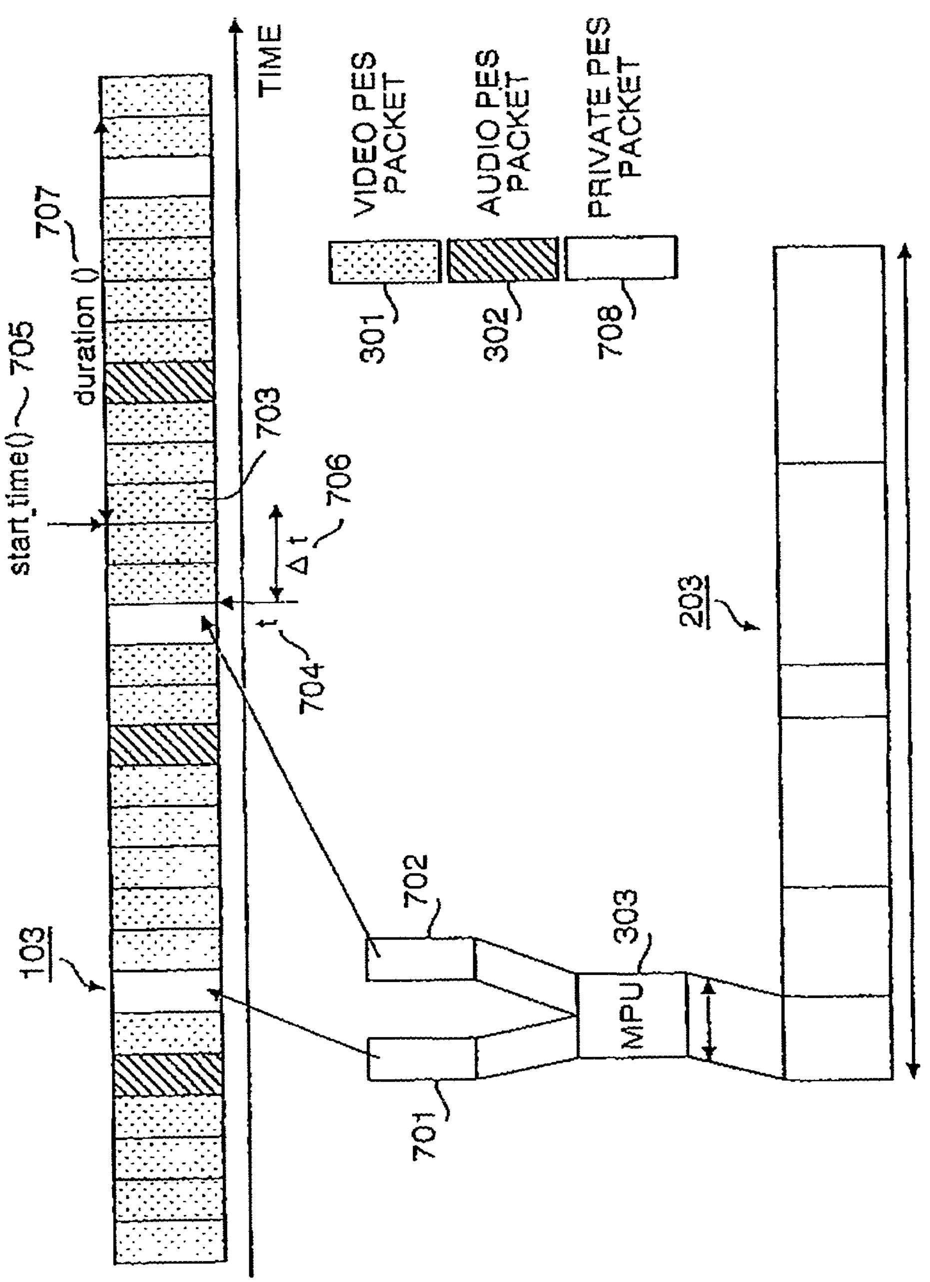

103
start_time()
705
duration ()
707
703
Δ t
706
t
704
TIME
VIDEO PES PACKET
AUDIO PES PACKET
PRIVATE PES PACKET
301
302
708
701
702
MPU
303
203
METADATA

FIG. 7

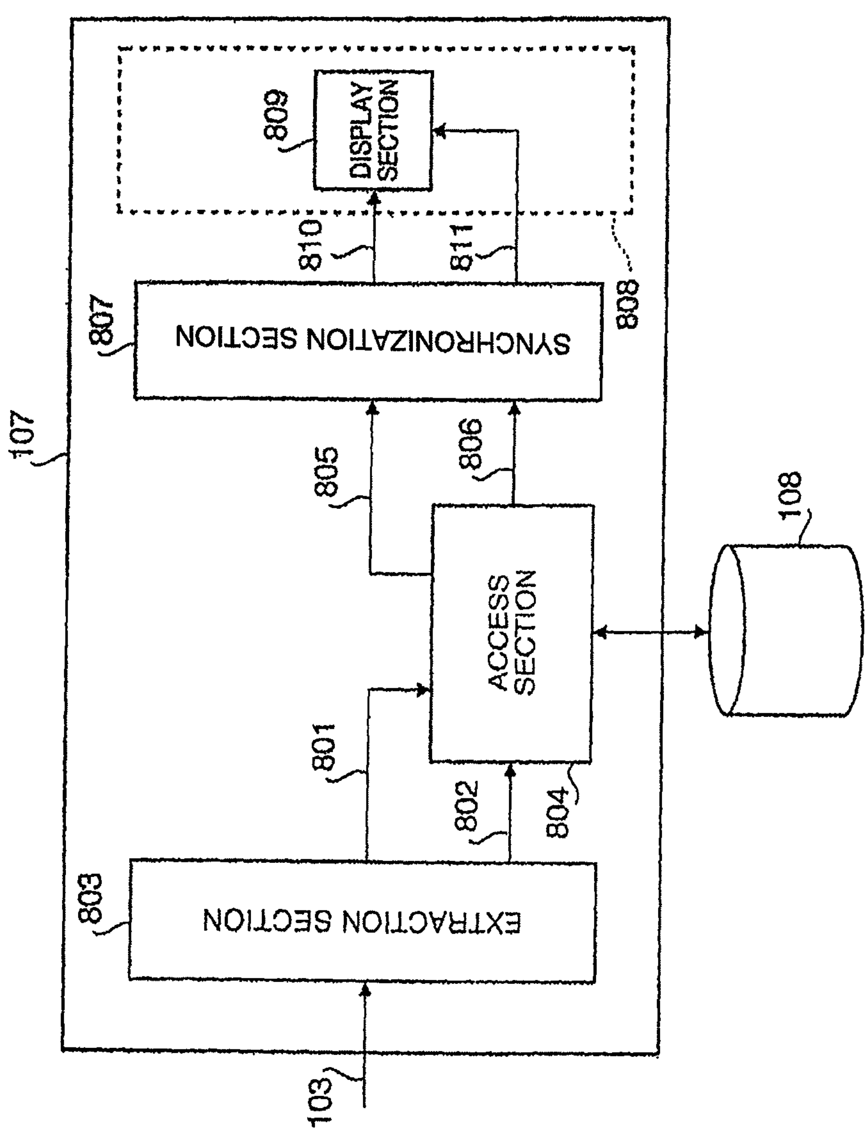

107
103
803
EXTRACTION SECTION
801
802
804
ACCESS SECTION
805
806
108
807
SYNCHRONIZATION SECTION
810
811
808
809
DISPLAY SECTION

FIG. 8

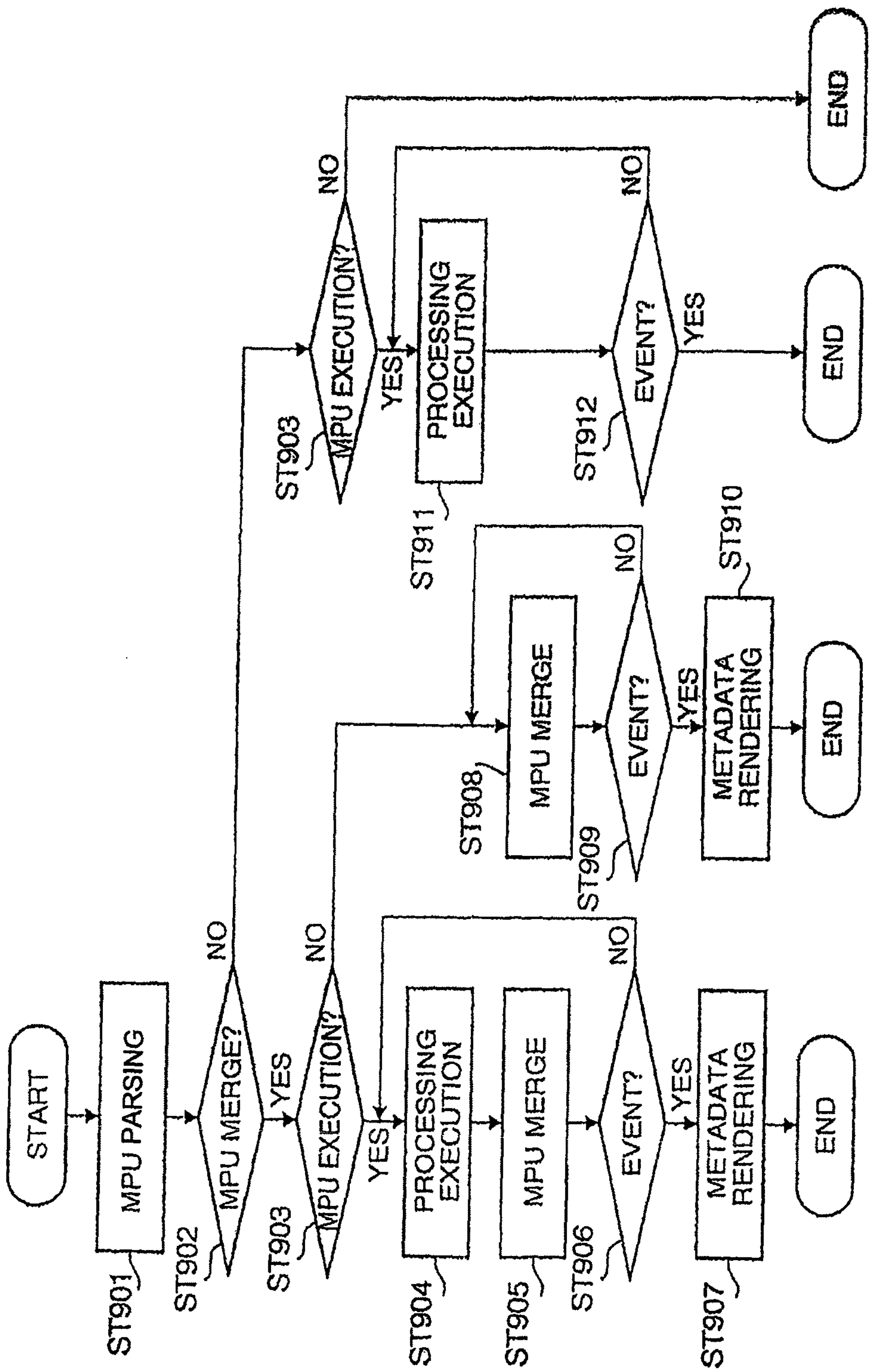
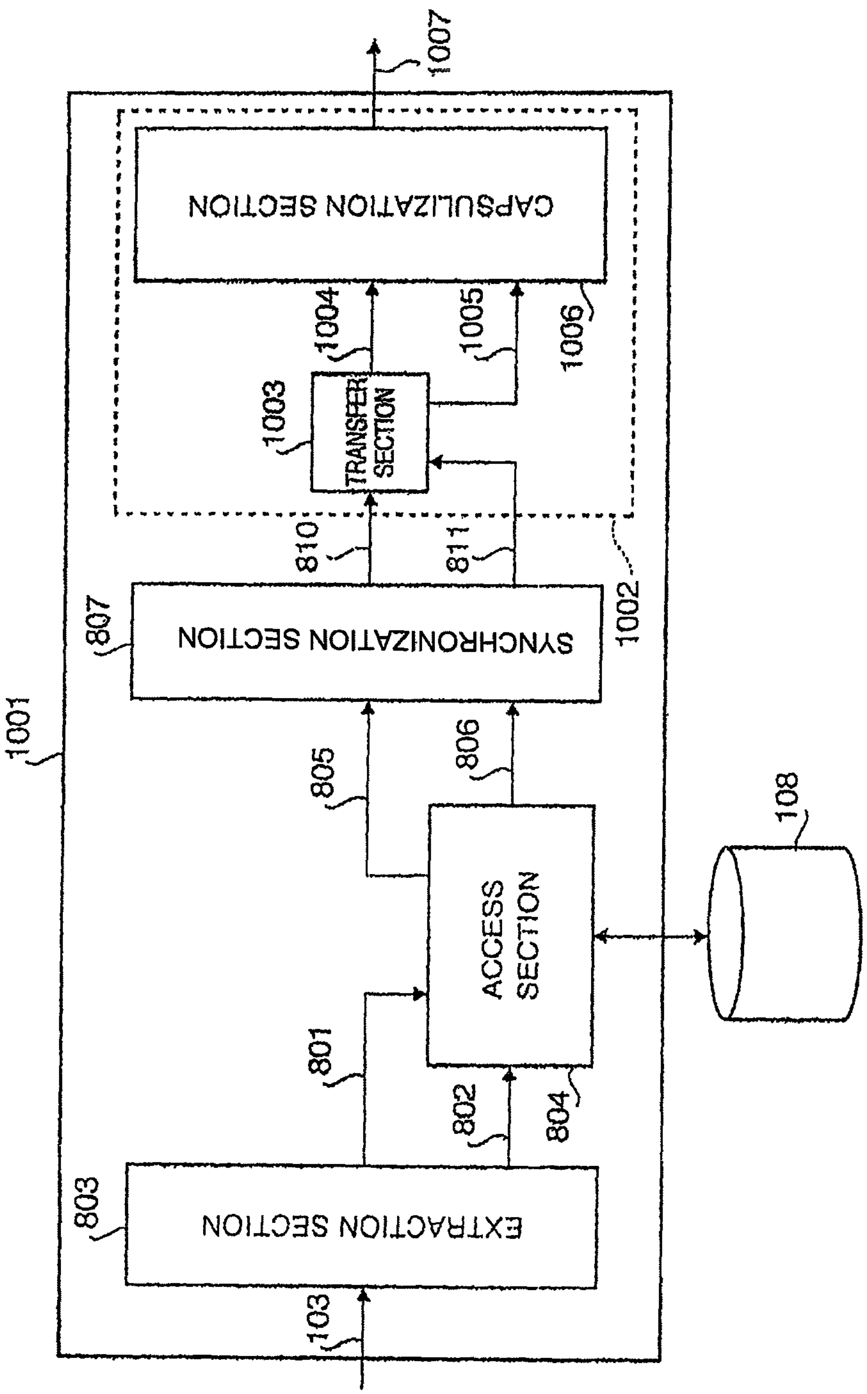

START
MPU PARSING
ST901
MPU MERGE?
ST902
YES
NO
MPU EXECUTION?
ST903
YES
NO
PROCESSING EXECUTION
ST904
MPU MERGE
ST905
EVENT?
ST906
YES
NO
METADATA RENDERING
ST907
END
MPU MERGE
ST908
EVENT?
ST909
YES
NO
METADATA RENDERING
ST910
END
MPU EXECUTION?
ST903
YES
NO
PROCESSING EXECUTION
ST911
EVENT?
ST912
YES
NO
END
END

FIG. 9



1007
CAPSULIZATION SECTION
1004
1005
1006
1003
TRANSFER SECTION
810
811
1002
SYNCHRONIZATION SECTION
807
1001
805
806
ACCESS SECTION
108
801
802
804
EXTRACTION SECTION
803
103

FIG. 10

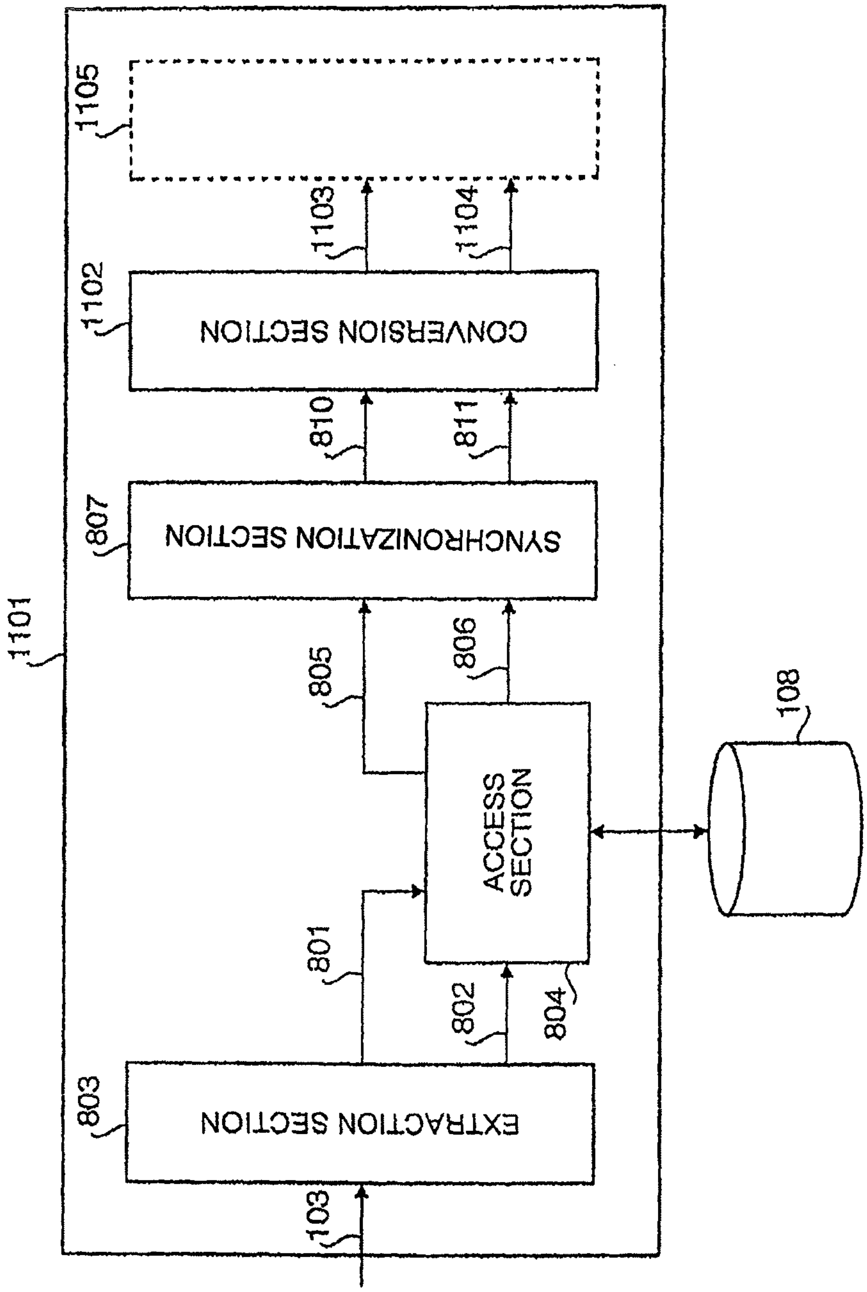

1101
1105
1103
1104
1102
CONVERSION SECTION
810
811
807
SYNCHRONIZATION SECTION
805
806
ACCESS SECTION
108
801
802
804
803
EXTRACTION SECTION
103

FIG. 11

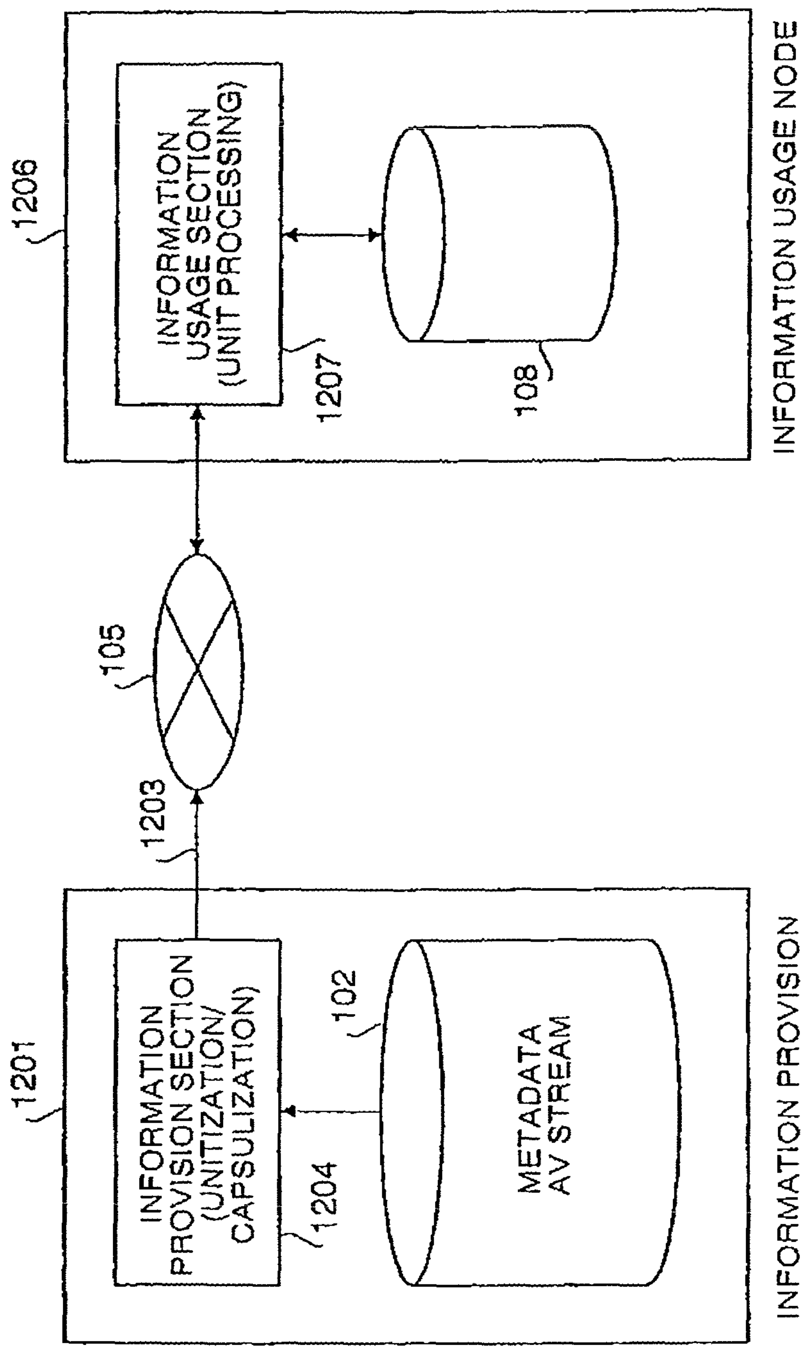

1206
INFORMATION USAGE SECTION (UNIT PROCESSING)
1207
108
INFORMATION USAGE NODE
105
1203
1201
INFORMATION PROVISION SECTION (UNITIZATION/ CAPSULIZATION)
1204
102
METADATA AV STREAM
INFORMATION PROVISION NODE

FIG. 12

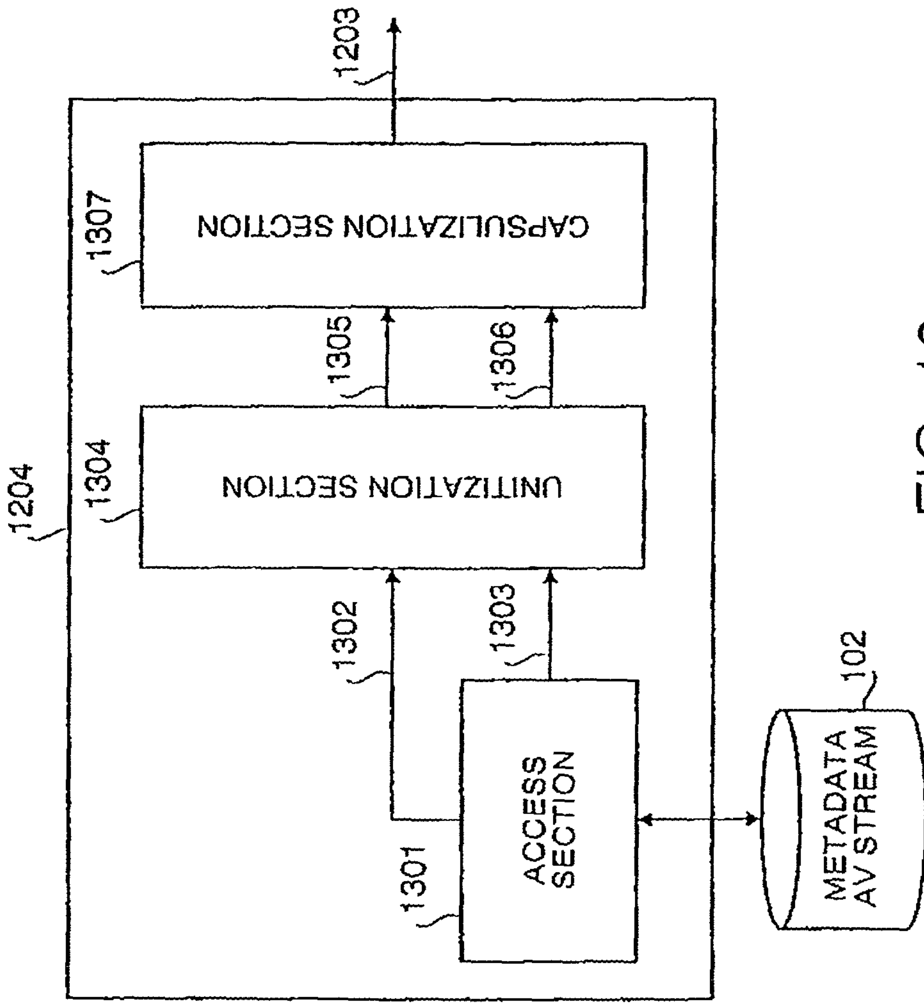
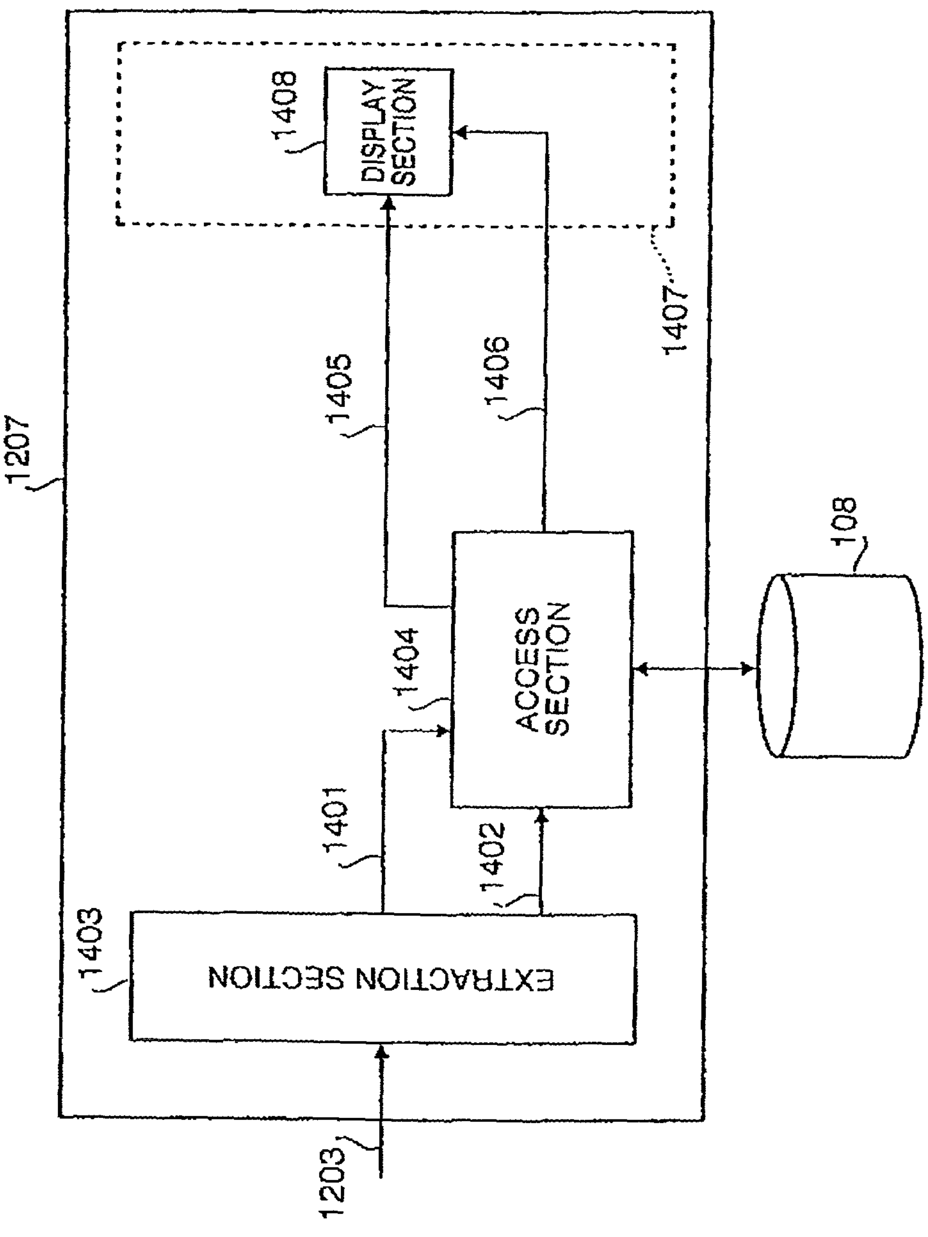

1203
1204
1307
CAPSULIZATION SECTION
1305
1306
1304
UNITIZATION SECTION
1302
1303
1301
ACCESS SECTION
102
METADATA AV STREAM

FIG. 13



1207
1408
DISPLAY SECTION
1407
1405
1406
1404
ACCESS SECTION
108
1401
1402
1403
EXTRACTION SECTION
1203

FIG. 14

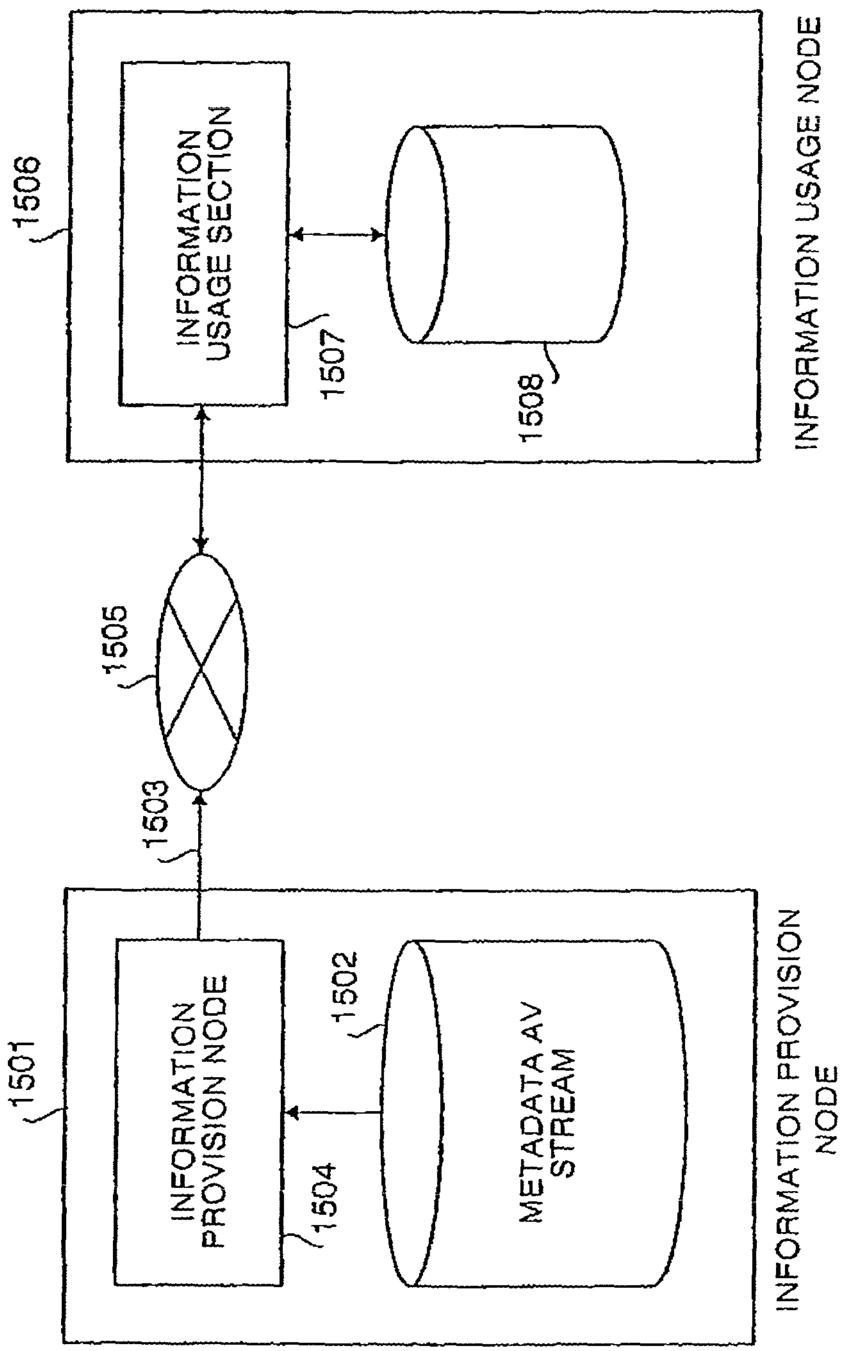

1501
INFORMATION PROVISION NODE
1504
1502
METADATA AV STREAM
INFORMATION PROVISION NODE
1503
1505
1506
INFORMATION USAGE SECTION
1507
1508
INFORMATION USAGE NODE

FIG. 15

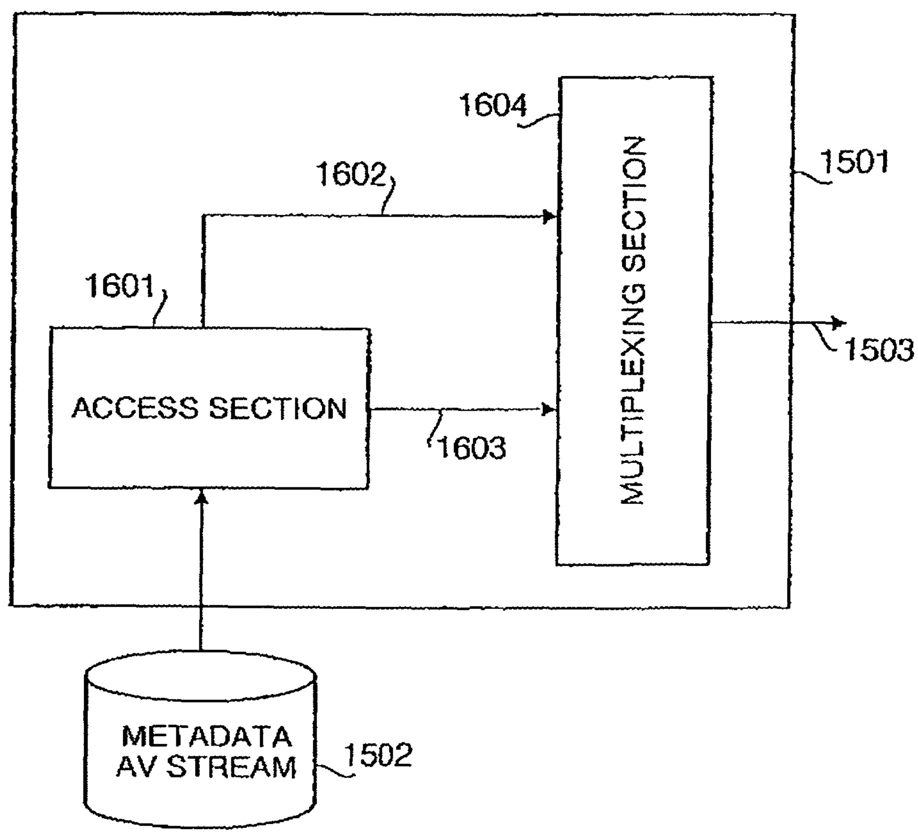

1604
MULTIPLEXING SECTION
1501
1602
1601
ACCESS SECTION
1503
1603
METADATA
AV STREAM
1502

FIG. 16

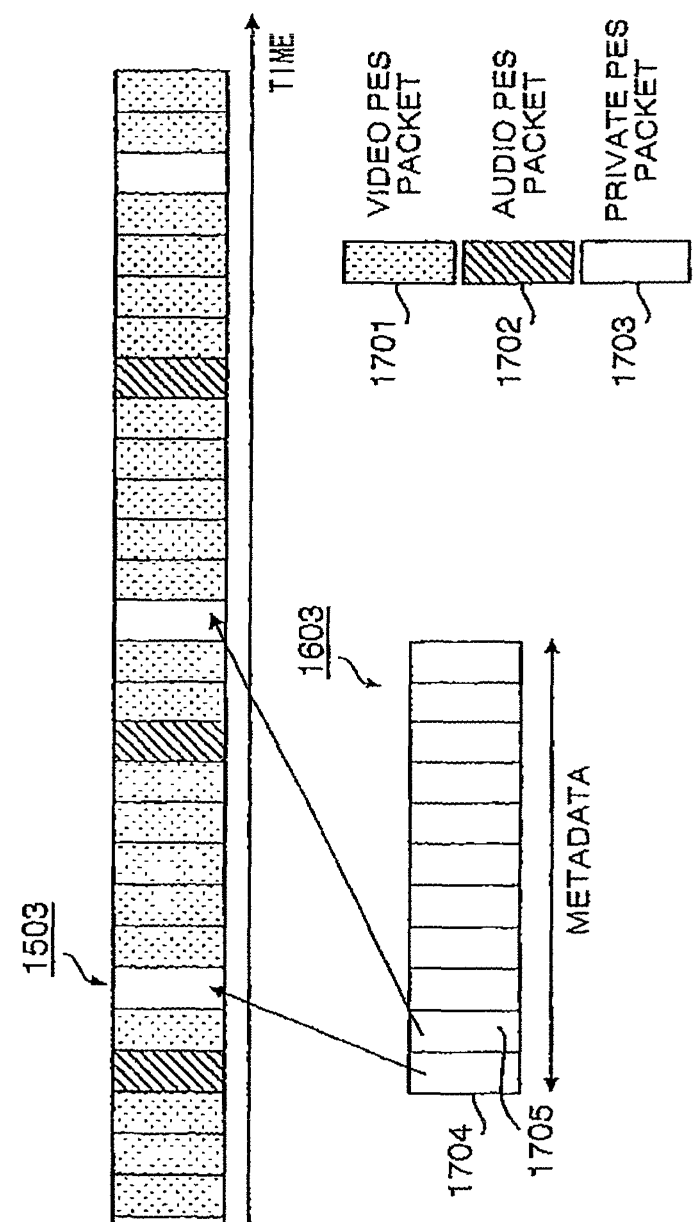

1503
TIME
1603
METADATA
1704
1705
VIDEO PES PACKET
AUDIO PES PACKET
PRIVATE PES PACKET
1701
1702
1703

FIG. 17

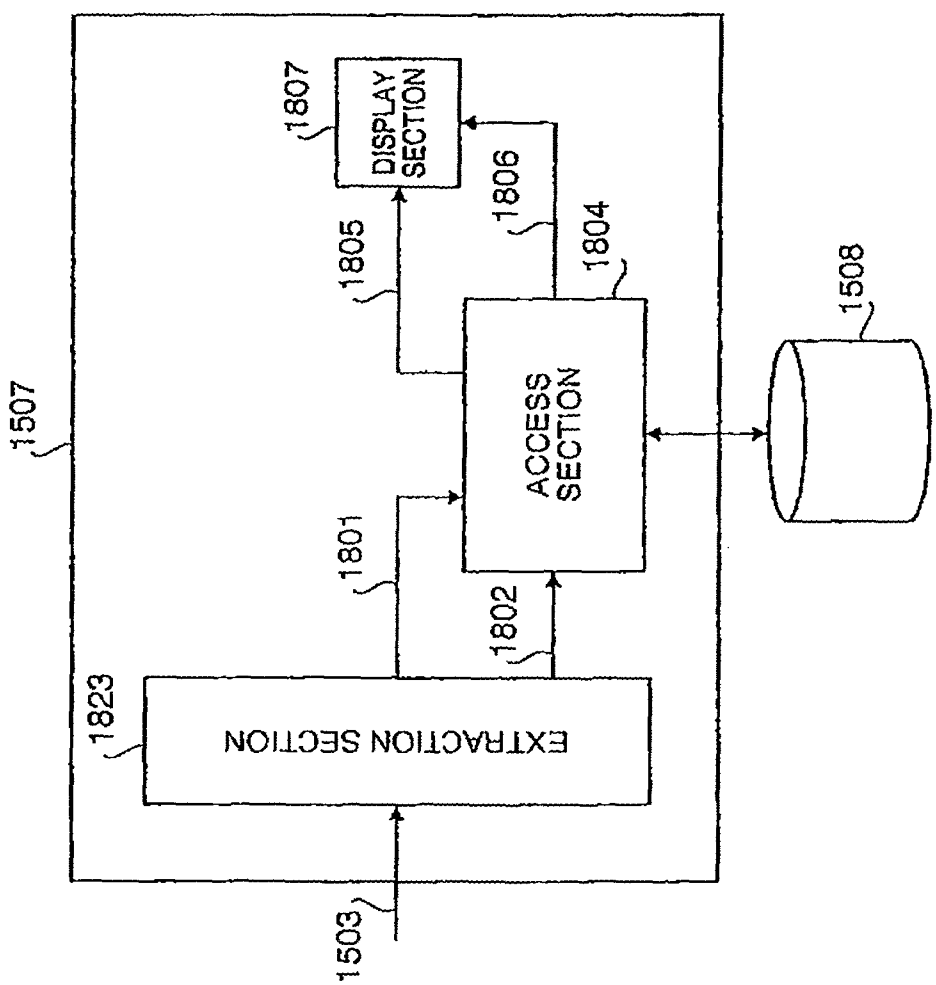

1507
1807
DISPLAY SECTION
1805
1806
1804
ACCESS SECTION
1801
1802
1823
EXTRACTION SECTION
1503
1508

FIG. 18

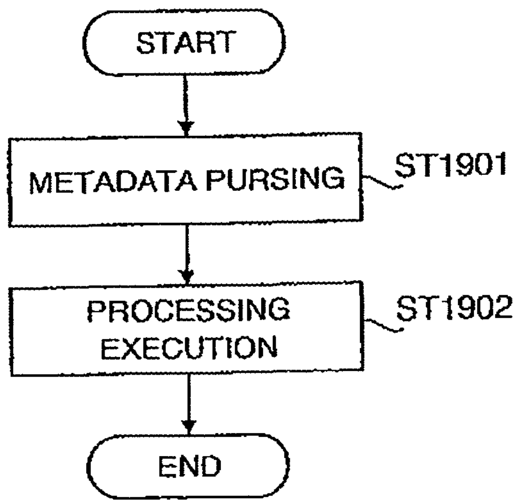

START
METADATA PURSING
ST1901
PROCESSING EXECUTION
ST1902
END

FIG. 19

APPARATUS AND METHOD FOR DECODING A SEGMENT OF AN AUDIOVISUAL STREAM

CROSS-REFERENCE PARAGRAPH

This is a continuing application of pending U.S. patent application Ser. No. 13/609,848, filed on Sep. 11, 2012, which is a continuation of U.S. patent application Ser. No. 13/165,111, filed on Jun. 21, 2011, now U.S. Pat. No. 8,555,328, issued Oct. 8, 2013, which is a continuation of U.S. patent application Ser. No. 12/899,860, filed on Oct. 7, 2010, now U.S. Pat. No. 7,992,182, issued on Aug. 2, 2011, which is a continuation of U.S. patent application Ser. No. 12/111,021, filed on Apr. 28, 2008, now U.S. Pat. No. 7,836,479, issued on Nov. 16, 2010, which is a continuation of U.S. patent application Ser. No. 10/019,319, filed on Jan. 10, 2002, now U.S. Pat. No. 7,383,566, issued on Jun. 3, 2008, which is a U.S. National Stage of International Application No. PCT/JP00/04736, filed on Jul. 14, 2000, which claims the benefit of Japanese Application No. 11-200095, filed Jul. 14, 1999, the contents of all of which are expressly incorporated by reference herein in their entireties. The International Application was not published under PCT Article 21(2) in English.

TECHNICAL FIELD

The present invention relates to an information provision apparatus, information receiving apparatus, and storage medium, and relates in particular to an information provision apparatus, information receiving apparatus, and storage medium for video/audio, data, etc., operating via broadcast media such as digital broadcasting and communication media such as the Internet.

BACKGROUND ART

In recent years, there has been an active trend of digitalization of broadcasting, and fusion with communications has also progressed. In the field of communications, satellite digital broadcasting has already been started, and it is expected that terrestrial broadcasting will also be digitalized in the future.

As a result of digitalization of broadcast content, data broadcasting is also performed in addition to conventional video and audio. Also, in the communications field, digital content distribution via the Internet has begun with music, and Internet broadcasting stations that broadcast video have also appeared.

Henceforth, it is envisaged chat continuous content media such as video and audio will enter the home via various paths (transmission media). Through such fusion and digitalization of communications and broadcasting, it has become possible to offer previously unavailable services by means of metadata that describes content or relates to content.

For example, EPG information as well as audio/video information is provided by interleaving EPG (Electric Program Guide)—"Standard specification for program arrangement information used in digital broadcasting ARIB STD-B10 Version 1.1" or "pr ETS 300 468 Digital Broadcasting systems (or television, sound and data services—Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems") used in CS digital broadcasting, in an audio/video PES (Packetized Elementary Stream) using

an MPEG-2 (Motion Picturecoding Experts Group phase 2—"ISO/IEC 13818-1 to 3") private section.

Also, in BS digital broadcasting, data broadcasting using MPEG-2 private PES packets is anticipated. Moreover, it is also possible to perform content management by inserting metadata that describes content in the format of user data in material transmission ("ANSI/SMPTE291M-1996 Ancillary Data Packet and space Formatting").

A conventional information processing system will be described below using FIG. **15**. FIG. **15** is a block diagram of a conventional information processing system.

An information provision node **1501** is provided with a storage section **1502** in which an AV stream and metadata for describing the AV stream are stored. Also provided in the information provision node **1501** is an information provision section **1504** that multiplexes the AV stream and metadata stored in the storage section **1502** and generates and outputs a multiplex stream **1503**. The information provision section **1504** transmits the multiplex stream **1503** to an information usage node **1506** via a network **1505**.

Meanwhile, the information usage node **1506** is provided with an information usage section **1507** that extracts an AV stream and metadata from a multiplex stream and executes processing on them in order to use them. The information usage node **1506** is also provided with a storage section **1508** that stores the AV stream and metadata extracted by the information usage section **1507**. The information usage section **1507** reads the AV stream and metadata stored in the storage section **1508** in order to use them.

Next, the information provision section **1504** will be described using FIG. **16**. FIG. **16** is a block diagram of a conventional information provision section.

The information provision section **1504** is provided with an access section **1601** that reads an AV stream and metadata from the storage section **1502**. The access section **1601** outputs an AV stream **1602** and metadata **1603** to a multiplying section **1604**.

The multiplexing section **1604** transmits to the information usage node **1506** a multiplex stream **1503** that multiplexes the AV stream **1602** and metadata **1603**.

Next, multiplex stream generation processing by the multiplexing section **1604** will be described using FIG. **17**.

The drawing indicated by reference numeral **1503** in the drawing shows the MPEG-2 TS (Transport Stream) PES packet layer, and shows a multiplex stream. The drawing indicated by reference numeral **1702** shows a video PES packet, the drawing indicated by reference numeral **1703** shows an audio PES packet, and the drawing indicated by reference numeral **1703** shows a private PES packet. **1603** indicates the metadata PES packet layer, in which **1704** is a first PES packet comprising metadata and **1705** is a second PES packet comprising metadata.

The multiplexing section **1604** divides the metadata **1603** to make private PBS packets, inserts the first PES packet **1704** and second PES packet **1705** in order as appropriate between AV streams consisting of video PES packets **1701** and audio PES packets **1702**, and obtains a multiplex stream **1503** that is an MPEG-2 TS.

As conventional metadata is AV stream ancillary data—for example, small amounts of data such as titles—processing has been performed with metadata alone. That is to say, it has not been necessary to provide time synchronization of metadata with an AV stream. Therefore, since conventional metadata does not have a configuration that provides for synchronization with an AV stream, metadata has been packetized using virtually the same size, and has been inserted as appropriate between AV streams at virtually equal intervals.

The multiplexing section **1601** then sends this multiplex stream **1503** to the information usage node **1506**.

Next, the information usage section **1507** will be described using FIG. **18**. FIG. **18** is a block diagram of a conventional information usage section.

The information usage section **1507** is provided with an extraction section **1803** that performs separation and extraction, and output, of an AV stream **1801** and metadata **1802**. The extraction section **1803** outputs the separated and extracted AV stream **1801** and metadata **1802** to an access section **1804**.

The access section **1801** stores the AV stream **1801** and metadata **1802** input from the extraction section **1803** in a storage section **1508**. Also, the access section **1804** outputs the AV stream **1805** and metadata **1806** read from the storage section **1508** to a display section **1807**. The display section **1807** displays either or both of the AV stream **1805** and metadata **1806** input from the access section **1804**.

Next, the processing of the information usage section **1507** will be described using FIG. **19**. FIG. **19** is a processing flowchart of a conventional information usage section.

The extraction section **1803** performs metadata parsing—that is, syntax analysis (ST**1901**). Then, execution of the processing of the access section **1804** and display section **1807** is performed (ST**1902**).

In this way, a conventional information processing system can display a description relating to AV information, in addition to AV information, by means of the information usage node **1506** by having the information provision node **1501** transmit a multiplex stream multiplexing an AV stream and metadata to the information usage node **1506**.

In recent years, a demand has arisen for various kinds of information to be included in metadata, and for metadata to be processed coupled with an AV stream, rather than having metadata simply as ancillary data for an AV stream.

However, in the above-described conventional information processing system, metadata parsing cannot be carried out until all the metadata has been acquired. For example, if metadata begins with <metadata>, metadata parsing cannot be carried out until data </metadata> indicating the end of the metadata arrives.

For this reason, the metadata processing time is closely tied to the AV stream display or processing time, and since an AV stream is processed in accordance with the metadata itself, processing cannot be started until all the metadata has been received. Therefore, in a conventional information processing system, there is a problem in that it is difficult to process an AV stream in small units.

Also, metadata is distributed virtually uniformly in a multiplex stream. As a result, especially when the data quantity of metadata is large, a large AV stream quantity must be read by the time all the metadata is read. Consequently, there are problems relating to inter-node response time delays and increased network traffic.

DISCLOSURE OF INVENTION

It is a first objective of the present invention to carry out data and program distribution for processing a segment comprising part of an AV stream, speeding up of response times, reduction of the necessary storage capacity, and reduction of network traffic, by making possible partial execution of metadata.

Also, it is a second objective of the present invention to make processing of a segment comprising part of an AV stream variable, and perform close synchronization between metadata and AV stream processing times, by implementing time synchronization of metadata and an AV stream.

Further, it is a third objective of the present invention to extend the degree of freedom for designing metadata for processing an AV stream.

In order to meet the first objective, the present invention is provided with a synchronization section which synchronizes a data stream segment with a unit of metadata corresponding to it, and a capsulization section which capsulizes a data stream packet and metadata unit packet after synchronization and generates a capsulized stream.

By this means, partial execution of metadata is made possible by reconfiguring metadata unit by unit and capsulizing it with the data stream. As a result, it is possible to carry out data and program distribution for processing a segment comprising part of a data stream, speeding up of response times, reduction of the necessary storage capacity, and reduction of network traffic.

In order to meet the second objective, the present invention is provided with an extraction section which extracts from a capsulized stream a content data stream and metadata for describing or processing that content, a synchronization section which synchronizes metadata unitized with respect to an extracted data stream segment unit by unit with a content data stream and the corresponding metadata unit, and a processing section which processes synchronized metadata unit by unit.

By this means, it is possible to make processing for a segment comprising part of a data stream variable, and perform close synchronization between meta data and AV stream processing times.

In order to meet the third objective, the present invention uses a structured description for metadata and metadata units, and structured description re-format is performed from metadata to units and from units to metadata.

By this means, it is possible to extend the degree of freedom for designing metadata for processing a data stream. In addition, it is possible for a structured description written in XML, etc., to be used directly as metadata.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a block diagram of an information processing system according to Embodiment 1 of the present invention;

FIG. **2** is a block diagram of an information processing section according to Embodiment 1;

FIG. **3**A is a drawing showing an AV stream according to Embodiment 1;

FIG. **3**B is a drawing showing metadata according to Embodiment 1;

FIG. **4**A is a drawing showing DTD of XML of metadata according to Embodiment 1;

FIG. **4**B is a drawing showing DTD of XML of an MPU according to Embodiment 1;

FIG. **5**A is a drawing showing an instance of XML of metadata according to Embodiment 1;

FIG. **5**B is a drawing showing an instance of XML of an MPU according to Embodiment 1;

FIG. **6** is a drawing showing the syntax of metadata according to Embodiment 1;

FIG. **7** is a drawing for explaining the operation of a capsulization section according to Embodiment 1;

FIG. **8** is a block diagram of an information usage section according to Embodiment 2 of the present invention;

FIG. **9** is a processing flowchart showing the metadata processing operations of an information usage node according to Embodiment 2 of the present invention;

FIG. **10** is a block diagram of an information usage section according to Embodiment 3 of the present invention;

FIG. **11** is a block diagram of an information usage section according to Embodiment 4 of the present invention;

FIG. **12** is a block diagram of an information processing system according to Embodiment 5 of the present invention;

FIG. **13** is a block diagram of an information processing section according to Embodiment 5;

FIG. **14** is a block diagram of an information usage section according to Embodiment 4 of the present invention according to Embodiment 6;

FIG. **15** is a block diagram of a conventional information processing system;

FIG. **16** is a detailed drawing of a conventional information provision section;

FIG. **17** is a drawing showing the configuration of a conventional multiplex stream;

FIG. **18** is a detailed drawing of a conventional information usage section; and

FIG. **19** is a processing flowchart for a conventional extraction section.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference now to the attached drawings, embodiments of the present invention will be explained in detail below.

Embodiment 1

An information processing system according to Embodiment 1 of the present invention will be described below. FIG. **1** is a block diagram of an information processing system according to Embodiment 1.

An information provision node **101** is provided with a storage section **102** in which an AV stream and AV stream related metadata are stored. The metadata is data that describes the related AV stream, or data for processing the metadata itself, or the like. Also provided in the information provision node **101** is an information provision section **101** that multiplexes the AV stream and metadata stored in the storage section **102** and generates and outputs a capsulized stream **103**. The information provision section **104** transmits the capsulized stream **103** via a network **105** to an information usage node **106**, which is an apparatus on the information receiving side.

Meanwhile, the information usage node **106** is provided with an information usage section **107** that extracts an AV stream and metadata from the capsulized stream **103** and executes predetermined processing on them in order to use them. The information usage node **106** is also provided with a storage section **108** that stores the AV stream and metadata extracted by the information usage section **107**. The information usage section **107** reads the AV stream and metadata stored in the storage section **108** in order to use them.

Next, the information provision section **104** will be described using FIG. **2**. FIG. **2** is a block diagram of an information provision section according to Embodiment 1.

The information provision section **104** is provided with an access section **201** that reads an AV stream and metadata from the storage section **102**. The access section **201** outputs an AV stream **202** and metadata **203** to a synchronization section **204**.

The synchronization section **204** implements time synchronization for the AV stream **202** and metadata **203** read by the access section **201**, and outputs the synchronized AV stream **205** and metadata **206** to a capsulization section **207**.

The capsulization section **207** capsulizes the synchronized AV stream **205** and metadata **206**, and transmits them to the information usage node **106** as a capsulized stream **103**.

Also, the present invention unitizes metadata to enable metadata to be executed in parts. Then, AV stream segments and corresponding metadata units are synchronized, synchronized data stream packets and metadata unit packets are capsulized, and a capsulized stream is generated.

The operation of the information provision section **104** of the present invention will be described in detail below.

First, the AV stream **202** and metadata **203** stored in the storage section **102** will be described using FIG. **3**A and FIG. **3**B.

The AV stream **202** has video PES packets **301** and audio PES packets **302** interleaved to form a stream. In the present embodiment, a mode is described whereby an AV stream **202** is scored in the storage section **102**, but a mode is also possible whereby a video stream and audio stream are stored.

The metadata **203** is configured so as to have a plurality of MPUs (Metadata Processing Units) **303**.

The thus configured metadata **203** and AV stream **202** are read from the storage section **102** by the access section **201**. Then the access section **201** outputs the read AV stream **202** and metadata **203** to the synchronization section **204**.

On receiving the AV stream **202** and metadata **203**, the synchronization section **204** first proceeds to processing for unitizing the metadata **203**. Here, definitions of the metadata **203** and MPU **303** will be described using FIG. **4**A and FIG. **4**B. FIG. **4**A and FIG. **4**B are drawings showing DTD of XML. In FIG. **4**A, **401** is a drawing showing a metadata definition (metadata.dtd) that defines the metadata **203**. In FIG. **4**B, the drawing indicated by reference numeral **402** shows an MPU definition (mpu.dtd) that defines an MPU **303**.

The metadata definition **401** defines the metadata **203** as having one or more MPUs **303**. For the contents of an MPU **303**, referencing the MPU definition **402** is defined.

The MPU definition **402** defines an MPU **303** as having one or more element_data items. For the contents of element_data, referencing user_defined.dtd is defined. Also, the MPU definition **402** defines an MPU **303** as having a serial number no assigned.

In this way, it is possible to include in an MPU **303** different processing contents for each of various services according to user_defined.dtd. Thus, it is possible to extend the degree of freedom for designing metadata for processing an AV stream.

Also, it is possible to include in an MPU **303** processing Contents not in accordance with a transmission specification, according to user_defined.dtd. By this means, metadata can also be used for a different transmission specification, making it possible to provide metadata services that support a variety of transmission specifications.

Next, the unitization of metadata **203** will be described using FIG. **5**A and FIG. **5**B. In FIG. **5**A, the drawing indicated by reference numeral **501** shows metadata (XML instance) whereby metadata **203** is given a structured description according to metadata definition **401**, and the drawing indicated by reference numeral **502** shows an MPU (XML instance) whereby an MPU **303** is given a structured description according to MPU definition **402**.

As described above, according to metadata definition **401**, metadata **203** is represented by a collection of MPU definitions **402**. According to this metadata definition **401**, what gives a structured description of metadata **203** is metadata (XML instance) **501**. As can be seen from the drawing, the metadata (XML instance) **501** instance includes a plurality of MPUs **303**. Also, metadata **203** is stored in the storage section **102** as metadata (XML instance) **501**.

According to MPU definition **402**, an MPU **303** is represented by a collection of metadata defined by user_defined.dtd. According to this MPU definition **402**, what gives a structured description of MPU **303** for each MPU is MPU (XML instance) **502**. As can be seen from the drawing, MPU (XML instance) **502** includes a plurality of user_defined.dtd items. Also, MPU **303** is stored in the storage section **102** as MPU (XML instance) **502**.

An MPU **303** has contents <mpu> to </mpu>. That is to say, if there is information from <mpu> to </mpu>, the synchronization section **201** can grasp MPU **303** contents and can perform MPU **303** processing. For this reason, when picking out an MPU **303** front metadata **203**, the synchronization section **204** extracts the contents on the inside of a tag called an MPU tag (here, <mpu>) defined by an MPU definition **402**.

By having metadata **203** composed of lower-level information MPUs **303** in this way, the synchronization section **204** can perform metadata **203** processing for each MPU **303**, and also closely synchronize the AV data **202** and metadata **203**.

Next, the synchronization section **204** capsulizes metadata **203** sent from the access section **201** using the syntax shown in FIG. **6**. FIG. **6** shows the syntax of metadata according to Embodiment 1 and Embodiment 2.

In FIG. **6**, metadata_type **601** is the metadata type such as position information, content information, or program, metadata_subtype **602** is the concrete metadata type such as GPS or structured description (MPEG-7). MPU_length **603** is the data length as a number of bytes from immediately after the MPU_length field to the end of the MPU. An MPU is composed of one or more PES packets, and is the regeneration unit of metadata divided when a Metadata Elementary Stream is encoded. media_sync_flag **604** is a flag indicating the presence or absence of synchronization between the AV stream and metadata, overwrite_flag **605** is a flag indicating whether the previous metadata is to be overwritten. element_data_length **606** is the data byte length (M) of element_data **609**. Start_time( ) **607** is the start time of a segment that is a part of the AV stream indicated by the metadata. duration( ) **608** is the continuation time of a segment that is part of the AV stream indicated by the metadata. element_data **609** is the actual data of the metadata.

For the syntax shown in FIG. **6**, coding uses syntax **610** from else downward even when the metadata data quantity is small and unitization is not performed.

The synchronization section **204** capsulizes the AV stream segment for processing specified by the first packet's processing start time **607** and duration **608**, and part of the metadata **203** corresponding to the segment for processing, as a capsulized stream (private PES).

When metadata **203** is PES-packetized, an MPU **303** is packetized together with the AV stream segment first packet processing start time (start_time), duration( ) **608**, and actual data of the metadata as an element (element_data) in the metadata syntax shown in FIG. **6**.

By this means, it is possible for an MPU **303** to have information for maintaining synchronization with the AV stream **202**. Thus, synchronization is maintained between the MPU **303** and AV stream **202**. In this way, metadata **203** operation can be determined on the information provision node **101** side.

Also, in Embodiment 1, an MPU **303** is composed of two packets—a first PES packet **701** and a second FES packet **702**—as shown in FIG. **7**. The operations whereby the synchronization section **204** packetizes an MPU **303** into private PBS packets and interleaves these with video PES packets **301** and audio PES packets **302** in this case will be described using FIG. **7**. How many packets an MPU **303** is made into can be determined arbitrarily according to the MPU **303** size and the packet size.

In the case of Embodiment 1, the first PES packet **701** and second PES packet **702** are placed as private PES packets **708** earlier in time than the first packet **703** so that the first PES packet **701** and second PES packet **702** are processed before the processing start time (start_time) **705** of the first packet of the corresponding AV stream segment.

Also, the second PES packet **702** arrival time t **704** and the corresponding first packet **703** processing start time (start time) **705** difference at **706** are assigned sufficient times for the information usage section **107**, which is on the information receiving side, to generate an MPU **303** from the first PES packet **701** and second PES packet **702**, and execute processing based on the contents of the generated MPU **303**.

Then, the AV stream **205** and metadata **206** synchronized by the synchronization section **201** in this way are input to the capsulization section **207**.

The capsulization section **207** capsulizes the input AV stream **205** and metadata **206**, and transmits them as a capsulized stream **103**.

As described above, according to Embodiment 1, metadata can be re-formatted unit by unit and capsulized with an AV stream by providing a synchronization section **204** that maintains synchronization of the AV stream and metadata, and a capsulization section **207** that capsulizes metadata unit by unit with the AV stream. By this means, it becomes possible to perform partial execution of metadata, and to carry out program distribution for processing a segment comprising part of an AV stream, speeding up of response times, reduction of the necessary storage capacity, and reduction of network traffic.

Moreover, according to Embodiment 1, by using a structured description written using XML for metadata and metadata units, and performing structured description reformat from metadata to units and from units to metadata, it is possible to provide extensibility for metadata for processing an AV stream, and extend the degree of freedom for designing metadata. In addition, it is possible for a structured description written in XML, etc., to be used directly as metadata.

Embodiment 2

Next, an information processing system according to Embodiment 2 of the present invention will be described. FIG. **8** is a block diagram of an information usage section **107** according to Embodiment 2.

The information usage section **107** is provided with an extraction section **803** that performs separation and extraction, and output, of an AV stream **801** and metadata **802**. The extraction section **803** outputs the extracted AV stream **801** and metadata **802** to an access section **804**.

The access section **804** records the AV stream **801** and metadata **802** in a storage section **108**. Also, the access section **804** reads an AV stream **805** and metadata **806** stored in the storage section **108**, and outputs them to a synchronization section **807**.

The synchronization section **807** performs time synchronization every MPU **303** for the AV stream **805** and metadata **806** read by the access section **804**, and outputs them to a core processing section **808**.

The core processing section **808** is provided with a display section **809**. The display section **809** performs time synchronization and display of the input synchronized AV stream **810** and metadata **811**.

In this way, the information usage section **107** extracts an AV stream **801** and metadata **802** from the capsulized stream **103** in the extraction section **803**. Then, in the synchronization section **807**, the corresponding metadata **802** unitized in accordance with AV stream **801** segments is synchronized with the AV stream **801** unit by unit. Then the synchronized metadata **811** and AV stream **810** a redisplayed unit by unit by the display section **809**.

Next, the metadata processing operations or the information usage node **106** will be described in detail using the flowchart in FIG. **9**. First, the extraction section **803** extracts an AV stream and metadata from the received capsulized stream **103**. In addition, the information usage section **107** performs MPU **303** pursing (ST**901**). Next, in the information usage section **107**, a check is performed as to whether the MPUs **303** are to be merged and re-formatted as metadata **802** (ST**902**). Then, in the information usage section **107**, a check is performed as to whether MPU **303** execution is co be performed unit by unit (ST**903**).

If, in ST**902** and ST**903**, the results confirmed by the information usage section **107** are MPU merging and MPU execution, processing is executed by the core processing section **808** (ST**904**). Then MPU merging is performed in the information usage section **107** (ST**905**). In Embodiment 2, this processing is display processing, but it may also be conversion processing or transfer processing as in other embodiments to be described hereafter.

Then, in the information usage section **107**, judgment as to the advent of an MPU time or number limit—that is, an event that indicates an MPU processing unit—is performed (ST**906**), and ST**904** and ST**905** are repeated until the advent of an event. Event information is given to software when providing universality, or is given to a terminal beforehand when the system is used in a fixed mode.

Then, in the information usage section **107**, rendering—that is to say, formatting—of the metadata is performed from the MPUs collected together in ST**906**. Metadata formatted on the basis of this event is stored in the storage section **108**. Then the core processing section **808** reads this formatted data and performs various kinds of processing.

In this way, it is possible not only to perform processing for each MPU, which is the minimum unit of processing, in ST**904**, but also to perform processing based on data obtained by merging MPUs according to an event.

By this means, it is possible to set arbitrarily a unit for MPU processing according to an event, and therefore the length of AV data segments for metadata processing can be made variable. That is to say, it is possible to process metadata for small AV data and to process metadata for huge AV data. For example, it is possible to update metadata display in short cycles in a case such as a vehicle navigation system, and update metadata in long cycles in a case such as a news program.

Also, by storing this metadata that has been formatted on the basis of an event in the storage section **108**, it is possible to read and process this information by means of user operations.

If, in ST**902** and ST**903**, the results confirmed by the information usage section **107** are MPU merging and MPU non-execution, an MPU merge is performed (ST**908**). Then, in the information usage section **107**, judgment as to the presence of an MPU time or number limit—that is, an event related to completion of an MPU merge—is performed (ST**909**), and ST**908** is repeated until the occurrence of an event. Rendering of the metadata is then performed from the MPUs collected together in processing P**107**. Then, in the information usage section **107**, rendering—that is to say, formatting—of the metadata is performed from the MPUs collected together in ST**906** (ST**910**). Metadata formatted on the basis of this event is scored in the storage section **108**. Then the core processing section **808** reads this formatted data and performs various kinds of processing.

In this way, it is possible not only to perform processing for each MPU, which is the minimum unit of processing, but also to perform processing based on data obtained by merging MPUs according to an event.

If, in ST**902** and ST**903**, the results confirmed by the information usage section **107** are MPU non-merging and MPU execution, processing is executed sequentially (ST**911**). Then, in the information usage section **107**, judgment as to the presence of an MPU time or number limit—that is, an event that indicates an MPU processing unit—is performed (ST**912**), and ST**911** is repeated until the occurrence of an event.

In this way, it is possible to perform processing for each MPU, which is the minimum unit of processing, and not to perform processing based on data obtained by merging MPUs according to an event.

If, in ST**902** end ST**903**, the results confirmed by the information usage section **107** are MPU non-merging and MPU non-execution, no particular MPU-related processing is performed.

As described above, the extraction method can be changed as appropriate according to the contents contained in MPUs **303**.

The operation of the information usage section **107** will now be described below. The information usage section **107** extracts an AV stream **801** and metadata **802** from the capsulized stream **103** input by the extraction section **803**, and outputs them to the access section **804**. After recording the AV stream **801** and metadata **802** in the storage section **108**, the access section **804** reads an AV stream **805** and metadata **806**, and outputs them to the synchronization section **807**. The synchronization section **807** performs time synchronization every MPU **303** for the AV stream **805** and metadata **806** read by the access section **804**, and outputs them to the core processing section **808**. In the core processing section **808**, the display section **809** performs time synchronization and display of the input AV stream **810** and metadata **811**.

As described above, according to Embodiment 2, close synchronization of the metadata and AV stream processing time can be performed by providing an extraction section **803** for separating and extracting an AV stream and metadata, an access section **804** for reading and writing an AV stream and metadata in a storage section **108**, a synchronization section **807** for performing synchronization of the read AV stream and metadata processing, and a display section **809**, which is a core processing section **808**. By this means, it is possible to vary processing for a segment, which is part of an AV stream.

Also, information relating to the display method used by the display section **809** of the core processing section **808** can be provided as metadata. Information relating to the display method includes position information for displaying metadata related information, display size information, and display update information.

By this means, an appropriate method for displaying metadata can be sent to the information provision node **101** by the information usage node **106**. As a result, metadata can be displayed appropriately by the information usage node **106**. Therefore, if metadata is an advertisement or the like, it is possible to make a specification that allows the advertisement to be displayed at the desired time, and if metadata is information related to program descriptions, it is possible to display the descriptive information so as not to interfere with images.

Moreover, according to Embodiment 2, by using a structured description written using XML for metadata and metadata units, and performing structured description reformat from metadata to units and from units to metadata, it is possible to extend the degree of freedom for designing metadata for processing an AV stream, and a structured description written in XML, etc., can be used directly as metadata.

Embodiment 3

Next, an in formation processing method according to Embodiment 3 of the present invention will be described. FIG. **10** is a block diagram of an information usage section **1001** according to Embodiment 3. Parts identical to those that have already been described are assigned the same reference numerals, and a description of these parts is omitted.

The information usage section **1001** according to Embodiment 3 has the core processing section **808** of the information usage section **1001** according to Embodiment 2 replaced by a core processing section **1002**. Below, the information usage section **1001** will be described centering on the core processing section **1002**.

The core processing section **1002** is provided with a transfer section **1003** and a capsulization section **1006**.

The transfer section **1003** performs settings, such as a destination setting, for transferring an AV stream **810** and metadata **811** input from the synchronization section **807** to another information usage node. The transfer section **1003** performs time synchronization every MPU **303**, and outputs an AV stream **1004** and metadata **1005** to the capsulization section **1006**.

The capsulization section **1006** recapsulizes the input AV stream **1004** and metadata **1005** and transmits them to another node as a capsulized stream **1007**. Since the capsulization section **1006** recapsulizes the AV stream **1004** and metadata **1005** in this way, load sharing can be performed while maintaining close synchronization between the metadata and AV stream processing times.

The operation of the capsulization section **1006** is similar to that of the capsulization section **207** according to Embodiment 1, and so a detailed description will be omitted here.

The operation of the information usage section **1101** will now be described below. The information usage section **1101** extracts an AV stream **801** and metadata **802** from the capsulized stream **103** input by the extraction section **803**, and outputs them to the access section **804**. After recording the AV stream **801** and metadata **802** in the storage section **108**, the access section **804** reads an AV stream **805** and metadata **806**, and outputs them to the synchronization section **807**.

The synchronization section **807** performs time synchronization every MPU **303** for the AV stream **805** and metadata **806** read by the access section **304**, and outputs them to the core processing section **1002**. The core processing section **1002** performs settings for transferring the AV stream **810** and metadata **811** input by the transfer section **1003** to another information usage node, and performs time synchronization and output to the capsulization section **1006** every MPU **303**. The capsulization section **1006** recapsulizes the input AV stream **1004** and metadata **1005** and transmits them to another node as a capsulized stream **1007**.

By configuring the information usage section **1001** as described above, it is possible for the transfer section **1003** to perform settings for transferring the AV stream **810** and metadata **811** input from the synchronization section **807** to another information usage node, perform time synchronization and output to the capsulization step **23** every MPU **303**, and for the capsulization section **1006** to recapsulize the AV stream **1004** and metadata **1005** input from the transfer section **1003** and transmit them to another node as a capsulized stream **1007**.

As described above, according to Embodiment 3, it is possible for load sharing to be performed while maintaining close synchronization between the metadata and AV stream processing times, and also to make processing for a segment comprising part of a data stream variable, by providing in the information usage section **1001** an extraction section **803** for separating and extracting an AV stream and metadata, an access section **804** for reading and writing an AV stream and metadata in a storage section **108**, a synchronization section **807** for performing synchronization of the read AV stream and metadata processing, and, in the core processing section **1002**, a transfer section **1003** and a capsulization section **1006**.

Moreover, according to Embodiment 3, it is also possible for information about the processing methods of the transfer section **1003** and capsulization section **1006**, or a processing program itself, to be made metadata. Processing method here refers to processing for changing the place where metadata is inserted according to the transfer destination, for instance. By this means, it is possible for the information provision node **101** to send appropriate information for transferring and capsulizing metadata to the information usage node **106**. As a result, it is possible for metadata to be transferred and capsulized appropriately by the information usage node **106**.

Embodiment 4

Next, an information processing system according to Embodiment 4 of the present invention will be described. FIG. **11** is a block diagram of an information usage section **1101** according to Embodiment 4. Parts identical to those that have already been described are assigned the same reference numerals, and a description of these parts is omitted.

The information usage section **1101** according to Embodiment 4 is equivalent to the information usage section **107** according to Embodiment 2 or the information usage section **1001** according to Embodiment 3 provided with a conversion section **1102**. Below, the information usage section **1101** will be described centering on the conversion section **1102**.

The conversion section **1102** converts an AV stream **810** in accordance with metadata **811**, and outputs the result to the core processing section **1105** as a T-AV stream **1103** and T-metadata **1104**. The conversion referred to here is color conversion according to the transmission destination terminal or display position, graphic information format conversion according to the transmission destination terminal or display position, or conversion of the voice format to an MP3 or portable phone format according to the transmission destination terminal.

The core processing section **1105** operates in the same way as either the core processing section **808** shown in Embodiment 2 or the core processing section **1002** shown in Embodiment 3.

If the core processing section **1105** is core processing section **808**, the core processing section **1105** is provided with a display section **809**. In this case the display section **809** performs display while carrying out time synchronization of the input T-AV stream **1103** and T-metadata **1104**.

If the core processing section **1105** is core processing section **1002**, the core processing section **1105** is provided with a transfer section **1003** and capsulization section **1006**. In this case, the transfer section **1003** performs settings for transferring the T-AV stream **1103** and T-metadata **1104** input by the transfer section **1003** to another information usage node, and performs time synchronization and output to the capsulization section **1006** every MPU **303**. The operation of the capsulization section according to Embodiment 3 is similar to that of the capsulization section **207** of Embodiment 1.

The operation of the information usage section **1101** will now be described below. The information usage section **1101** extracts an AV stream **801** and metadata **802** from the capsulized stream **103** input by the extraction section **803**, and outputs them to the access section **804**. After recording the AV stream **801** and metadata **802** in the storage section **108**, the access section **804** reads an AV stream **805** and metadata **806**, and outputs them to the synchronization section **807**. The synchronization section **807** performs time synchronization every MPU **303** for the AV stream **805** and metadata **806** read by the access section **804**, and outputs them to the conversion section **1102**. The conversion section **1102** then converts AV stream **810** according to metadata **811**, and outputs the results to the core processing section **1105** as a T-AV stream **1103** and T-metadata **1104**.

Then, if the core processing section **1105** is the core processing section **808** according to Embodiment 2, the display section **809** performs display while carrying out time synchronization of the input T-AV stream **1103** and T-metadata **1104**. If the core processing section **1105** is the core processing section **1002** according to Embodiment 1, the transfer section **1003** performs settings for transferring the T-AV stream **1103** and T-metadata **1304** input by the transfer section **1003** to another information usage node, and performs time synchronization and output to the capsulization section **1006** every MPU **303**. The capsulization section **1006** recapsulizes the input T-AV stream **1103** and T-metadata **1104**, and transmits them as a capsulized stream **1007**.

As described above, according to Embodiment 4, it is possible for the place where conversion processing is performed according to metadata to be made variable by having the information usage section **1101** provided with an extraction section **803** for separating and extracting an AV stream and metadata, an access section **804** for reading and writing an AV stream and metadata in a storage section **108**, a synchronization section **807** for performing synchronization of the read AV stream and metadata processing, and, as the core processing section **1105**, a usage program composed of a display section **809** or a transfer section **1003** and capsulization section **1006**. The place where conversion processing is performed may be, for example, a server, terminal, network node (gateway), or the like.

Moreover, according to Embodiment 4, it is possible to make processing for a segment comprising part of an AV stream variable. Also, AV stream and metadata conversion can be made possible.

Furthermore, according to Embodiment 4, performing further processing on a converted AV stream and metadata can be made possible.

Still further, according to Embodiment 4, by using a structured description written using XML for metadata and metadata units, and performing structured description reformat from metadata to units and from units to metadata, it is possible to extend the degree of freedom for designing metadata for processing an AV stream, and a structured description written in XML, etc., can be used directly as metadata.

In addition, according to Embodiment 4, it is possible for information relating to methods for processing metadata in the core processing section **1105**—the display method, transfer method, and capsulization method—to be made metadata.

Embodiment 5

Next, an information processing system according to Embodiment 5 of the present invention will be described. FIG. **12** is a block diagram of an information processing system according to Embodiment 5. Parts that have already been described are assigned the same reference numerals.

Embodiment 5 has a configuration that omits the processing for synchronizing an AV stream and metadata from the information provision section **104** according to Embodiment 1. By omitting synchronization processing in this way, when synchronization of an AV stream and metadata is not necessary, processing speed can be increased by omitting synchronization processing and the configuration can be simplified. Examples of cases where synchronization of an AV stream and metadata need not be performed include cases where metadata is sent all together as with header information and processing need only be performed unit by unit, where it is sufficient for metadata to be synchronized implicitly with the AV stream, where it is sufficient for predetermined control to be performed by the terminal on the information usage side, and where metadata need not be processed in real time.

The configuration of an information processing system according to Embodiment 5 will now be described below.

An information provision node **1201** is provided with a storage section **102** in which an AV stream and AV stream related metadata are stored. The metadata is data that describes the related AV stream, or data for processing the metadata itself, or the like. Also provided in the information provision node **1201** is an information provision section **1204** that capsulizes the AV stream and metadata stored in the storage section **102** and generates and outputs a capsulized stream **1203**. The information provision section **1204** transmits the capsulized stream **1203** via a network **105** to an information usage node **1206**, which is an apparatus on the information receiving side.

Meanwhile, the information usage node **1206** is provided with an information usage section **1207** that extracts an AV stream and metadata from the capsulized stream **1203** and executes predetermined processing on them in order to use them. The information usage node **1206** is also provided with a storage section **108** that stores the AV stream and metadata extracted by the information usage section **1207**. The information usage section **1207** reads the AV stream and metadata stored in the storage section **108** in order to use them.

Next, the information provision section **1204** will be described using FIG. **13**. FIG. **13** is a block diagram of an information provision section according to Embodiment 5.

The information provision section **1204** is provided with an access section **1301** that reads an AV stream and metadata from the storage section **102**. The access section **1301** outputs an AV stream **1302** and metadata **1303** to a unitization section **1304**.

The unitization section **1304** reforms metadata **1306** read by the access section **1301** into MPUs **303**, and also outputs the synchronized AV stream **1305** and metadata **1306** read by the access section **1301** to a capsulization section **1307**.

The capsulization section **1307** capsulizes the input AV stream **1305** and metadata **1306**, and transmits them to the information usage node **1206** as a capsulized stream **1203**.

In Embodiment 5, as in Embodiment 1, metadata is unitized to enable it to be executed in parts. Then, the AV stream and metadata units are packetized, data stream packets and metadata unit packets are capsulized, and a capsulized stream is generated.

The operation of the information provision section **1204** of the present invention will be described in detail below. Details of the AV stream **1302** and metadata **1303** stored in the storage section **102** are the same as for the AV stream **202** and metadata **203** according to Embodiment 1, so a description of these will be omitted here.

With the above-described configuration, metadata **1303** and an AV stream **1302** are read from the storage section **102** by the access section **1301**. Then the access section **1301** outputs the read AV stream **1302** and metadata **1303** to the unitization section **1304**.

On receiving the AV stream **1302** and metadata **1303**, the unitization section **1304** first proceeds to processing for unitizing the metadata **1303**.

Definitions of the metadata **1303** and MPUs **303** are the same as for the metadata **203** according to Embodiment 1 and the MPUs **303** described in Embodiment 1, so a descript ion of these will be omitted here. Also, the process of unitization of the metadata **1303** is the same as for unitization of the metadata **203** according to Embodiment 1, so a description of this will be omitted here.

According to metadata definition **101** shown in FIG. **4**A, metadata **1303** is represented by a collection of MPU definitions **402**. Therefore, metadata **1303** is given a structured description by means of metadata definition **401**, and is stored in the storage section **102** as metadata (XML instance) **501** shown in FIG. **5**A.

Also, according to MPU definition **402** shown in FIG. **4**B, an MPU **303** is represented by a collection of metadata defined by user_defined.dtd. Therefore, MPUs **303** are given a structured description for each MPU by means of MPU definitions **402**, and are stored in the storage section **102** as MPU (XML instance) **502** shown in FIG. **5**B.

An MPU **303** has contents <mpu> to </mpu>. That is to say, if there is information from <mpu> to </mpu>, the unitization section **1304** can grasp MPU **303** contents and can perform MPU **303** processing. For this reason, when picking out an MPU **303** from metadata **1303**, the unitization section **1304** extracts the contents on the inside of a tag called an MPU tag (here, <mpu>) defined by an MPU definition **402**.

By having metadata **1303** composed of lower-level information MPUs **303** in this way, the unitization section **1304** can perform metadata **1303** processing for each MPU **303**. By this means, the unitization section **1304** can process AV data **1302** and metadata **1303** unit by unit.

Next, as in Embodiment 1, the capsulization section **1307** capsulizes metadata **1306** sent from the unitization section **1304** using the syntax shown in FIG. **6**.

The capsulization section **1307** then capsulizes the AV stream segment for processing specified by the first packet's processing start time **607** and duration **608**, and part of the metadata **1303** corresponding to the segment for processing, as a capsulized stream (private PES).

The unitization section **1304** then packetizes MPUs **303** into private PES packets and interleaves these with video PES packets and audio PES packets.

Then the capsulization section **207** capsulizes the input AV stream **1305** and metadata **1306**, and transmits them as a capsulized stream **1203**.

As described above, according to Embodiment 5, metadata can be re-formatted unit by unit and capsulized with an AV stream by providing a unitization section **1304** that unitizes the AV stream and metadata, and a capsulization section **1307** that capsulizes the metadata unit by unit with the AV stream. By this means, it becomes possible to perform partial execution of metadata, and to carry out program distribution for processing a segment comprising part of an AV stream, speeding up of response times, reduction of the necessary storage capacity, and reduction of network traffic.

Moreover, since Embodiment 5, unlike Embodiment 1, omits synchronization processing, when synchronization of an AV stream and metadata is not necessary, processing speed can be increased by omitting synchronization processing and the configuration can be simplified.

Embodiment 6

Next, an information processing system according to Embodiment 6 of the present invention will be described. FIG. **14** is a block diagram of an information usage section **1207** according to Embodiment 6.

Embodiment 6 has a configuration that omits the processing for synchronizing an AV stream and metadata from the information usage section **107** according to Embodiment 2. By omitting synchronization processing in this way, when synchronization of an AV stream and metadata is not necessary, processing speed can be increased by omitting synchronization processing and the configuration can be simplified. Examples of cases where synchronization of an AV stream and metadata need not be performed include cases where metadata is sent all together as with header information and processing need only be performed unit by unit, where it is sufficient for metadata to be synchronized implicitly with the AV stream, where it is sufficient for predetermined control to be performed by the terminal on the information usage side, and where metadata need not be processed in real time.

The configuration of an information processing system according to Embodiment 6 will now be described below.

An information usage section **1207** is provided with an extraction section **1403** that extracts and outputs an AV stream **1401** and metadata **1402** from an input capsulized stream **1203**. The extraction section **1403** outputs the extracted AV stream **1401** and metadata **1402** to an access section **1404**.

The access section **1404** records the AV stream **1401** and metadata **1402** in a storage section **108**. Also, the access section **1404** reads an AV stream **1405** and metadata **1406** stored in the storage section **108**, and outputs them to a core processing section **1407**.

The core processing section **1407** operates in the same way as the core processing section **808** shown in Embodiment 2. If the core processing section **1105** is core processing section **808**, the core processing section **1407** is provided with a display section **1408**. In this case the display section **1408** displays the input AV stream **1405** and metadata **1406**.

In this way, the information usage section **1207** extracts an AV stream **1401** and metadata **1402** from the capsulized stream **1203** in the extraction section **1403**. Then, the display section **1408** displays metadata **1406** and AV stream **1405** unit by unit.

The operation of the information usage section **1207** will now be described below. The information usage section **1207** extracts an AV stream **1401** and metadata **1402** from the capsulized stream **1203** input by the extraction section **1403**, and outputs them to the access section **1404**. After recording the AV stream **1401** and metadata **1402** in the storage section **108**, the access section **1404** reads an AV stream **1405** and metadata **1406**, and outputs them to the core processing section **1407**. In the core processing section **1407**, the display section **1408** displays the input AV stream **1405** and metadata **1406**.

As described above, according to Embodiment 6, it is possible to make processing for a segment comprising part of a data stream variable by providing an extraction section **1403** for separating and extracting an AV stream and metadata, an access section **1404** for reading and writing an AV stream and metadata in a storage section **108**, and a display section **1408**, which is a core processing section **1407**.

Moreover, since Embodiment 6, unlike Embodiment 2, omits synchronization processing, when synchronization of an AV stream and metadata is not necessary, processing speed can be increased by omitting synchronization processing and the configuration can be simplified.

Embodiment 6 has been described as having a configuration in which the synchronization section **807** is omitted from Embodiment 2, but a configuration may also be used in which the synchronization section **807** is omitted from Embodiment 3 or 4.

In Embodiment 3 to Embodiment 6, each processing section is configured by having all or part of the respective operations stored as a program (software) on a computer-readable storage medium such as a CD-ROM or DVD, and having the operations of each processing section performed by the CPU of a computer, or the like, by having a computer read the program.

A mode is also possible whereby all or part of the operations of each processing section are stored on a storage medium on communication means such as the Internet or the like as a program (software), the program is downloaded to an information terminal via the Internet or the like, and the operations of each processing section are performed by the information terminal.

A mode is also possible whereby each processing section is configured using dedicated hardware.

In Embodiment 1 to Embodiment 6, descriptions have used an AV stream as a content data stream with timewise continuity, but the sane kind of effects as in the above-described embodiments can be obtained with not an AV stream but another stream, file, or small-volume information, as long as its use as a stream is considered useful.

In Embodiment 1 to Embodiment 6, metadata definitions and MPU definitions are performed using DTD of XML, but XML RDF or XML Schema may be used, or other definition means may also be used.

In Embodiment 1 to Embodiment 6, packetization has been described with MPEG-2 system PES packets, but an MPEG-1 system, MPEG-4, SMPTE Ancillary Data Packet, or another transmission, format, streaming format, or file format may also be used.

In Embodiment 1 to Embodiment 6, private PES has been used for the description of the transmission layer for sending metadata, but metadata PES, MPEG-7 PES, MPEG-2 PSI (Program Specific Information) Section (so-called carousel) promised for the future may also be used as a transmission layer.

In Embodiment 1 to Embodiment 4, as a synchronization variation, one MPU may also be inserted repeatedly to enable the necessary data to be received when starting reception midway.

In Embodiment 1 to Embodiment 6, the network **105** or **1505** may be a terrestrial broadcasting network, a satellite broadcasting network, a cable television network, a line switching network, a packet switching network, an ATM, the Internet, or another network, package medium, hard disk, memory, or the like.

This application is based on the Japanese Patent Application No. HEI 11-200095 filed on Jul. 14, 1999, entire content of which is expressly incorporated by reference herein.

INDUSTRIAL APPLICABILITY

As described above, according to the present invention, firstly, partial execution of metadata is made possible, and it is possible to carry out program distribution for processing a segment comprising part of an AV stream, speeding up of response times, reduction of the necessary storage capacity, and reduction of network traffic, by reconfiguring metadata unit by unit and capsulizing it with an AV stream; secondly, close synchronization between metadata and AV stream processing times can be performed by making processing of a segment comprising part of an AV stream variable; and thirdly, it is possible to extend the degree of freedom for designing metadata for processing an AV stream, and to use a structured description written in XML, etc., directly as metadata, by using a structured description by means of XML for metadata and metadata units, and performing structured description re-format from metadata to units and from units to metadata.

What is claimed is:

1. A decoding method for decoding an audiovisual stream that is divided into a plurality of segments, the decoding method comprising:

obtaining, by a network receiver, metadata that specify a segment out of the plurality of segments in a server, the metadata being described in a structured description;

obtaining, by the network receiver and from the server, the segment specified by the metadata;

deriving, by a processor, a start time for rendering the segment on a display; and

decoding, by the processor, the segment based on the metadata to generate decoded segment data before the start time.

2. The decoding method according to claim **1**,

wherein, in the decoding, the segment is decoded in response to an event occurring.

3. The decoding method according to claim 1, wherein the structured description is defined by extensible markup language schema.

4. The decoding method according to claim 1, wherein the metadata are obtained a predetermined time before the segment is obtained.

5. The decoding method according to claim 1, further comprising:

obtaining first metadata and a first segment specified by the first metadata;

obtaining second metadata and a second segment specified by the second metadata after both of the first metadata and the first segment are obtained; and

decoding the second segment to be directly subsequent to the first segment.

6. The decoding method according to claim 1, wherein the plurality of segments each comprise a part of the audiovisual stream, and

processing times of the plurality of segments are variable.

7. A decoding apparatus for decoding an audiovisual stream that is divided into a plurality of segments, the decoding apparatus comprising:

a processor; and

a memory storing instructions that, when executed by the processor, cause the processor to perform operations including:

obtaining metadata that specify a segment out of the plurality of segments, the metadata being described in a structured description;

obtaining the segment specified by the metadata;

deriving a start time for rendering the segment from the metadata; and

decoding the segment based on the metadata to generate decoded segment data before the start time.

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